THE

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ELECTRICAL REVIEW.

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UNIVERSITIES AND TRADE.

IN the January issue of the *Review of Reviews*, Mr. H. E. Morgan pleaded for the building of a half-way house between the University and the city office, to serve the purpose of a sort of superior Labour Exchange for introducing budding talent to remunerative employment in trade and commerce. The article has given rise to some newspaper comment of a very similar character to that which was made a short time ago in consequence of the observations of the chairman of one of our large electrical companies. In all these discussions, it seems to be accepted that there is some special virtue in University training, and some special repugnance to embarking in commercial work on the part of those who have received such training. Clearly there is a contradiction here. If the latter be true, there must be something defective in the training, and the Universities have not advanced with the times in teaching the dignity of labour, or the estimation of merit by results, rather than by inheritance or environment. Cobbett cannot be regarded as one quite capable of expressing the general opinion of his day, but his own opinion, recently republished, found utterance in the phrase: "I know what your *college* gentlemen are. They always have, and will have, the *insolence* to think themselves *our betters*; and our superior talents and industry and power and weight only excite their envy." English public schools and Universities have a fine record, but the raw material can go through both without acquiring either strength or finish. In consequence, the mere fact of University training is no proof of fitness for a business or any other career, and it is high time the idea that tone and character may be bought by an expensive education should be abandoned. But it is more than high time to recognise also that higher education is now a necessity in any branch of bread-winning. In the prevailing deprecatory attitude of the average English mind, it is the foreign example which is held up for comparison; but it is doubtful whether the appreciation of education in Germany to-day is higher than it was in Scotland a century ago, or even in England three centuries earlier, when Gresham, the founder of the Exchange which Queen Elizabeth proclaimed as "Royal," was sent to Cambridge to acquire the education then considered suitable for a merchant of London. It is, however, true that the English University for generations has been the favoured resort of the wealthy, or the necessary qualifying ground of the serious student who was unable to pass into the Church, the Law, or other profession, except through its portals. In other words, the University has been expensive and exclusive. Small wonder, then, if some old-time prejudices still remain. But what shall be said for the manager of an Employment Agency, who suggests in the *Standard* that the office hand from the University should be given special privileges over his less favoured colleagues?

Such a suggestion is, in itself, a reflection on University training, for it indicates a reliance on the source of an education rather than on the education itself. If the University man is not, as a result of his training, capable of proving his superior ability, it is folly to encourage him into any new path by holding out inducements in the form of special privileges. He must take his chance with the rest, and rise or fall in accordance with his capacity and character.

Some further comments on this question would almost lead to the impression that the educated business man is the exception rather than the rule. In fact, the business men of England differ but little from the business men of other countries, except, perhaps, in one respect—in comparison with their Continental fellows they have been too often content to limit their linguistic attainments. This is to be traced to the simple fact that the English language carries further than any other, but the international relationship of British commerce requires that a greater attention should be given to this matter, and the education of the day is tending to remedy the undoubted defect. The successful business man is as varied in other countries as in Great Britain. There are types everywhere of the cultivated and of the less well-educated, but shrewd and capable men, whose progress may be ascribed to instinct rather than to culture, to perception of an opportunity rather than to the absorption of knowledge from books.

The University man in business is, as we have seen, no new feature at home, even if, as probably is the case, other countries have in recent years outstripped us. Men of middle age will remember an inquiry in Parliament in the seventies regarding the appointment of a head to the Stationery Office, which was regarded as a "job" because the appointee had no previous experience of the work. They will remember, too, the vindication by a member of the Government, who was then Mr. W. H. Smith, and who related that he had placed at the head of his own immense business a gentleman from one of the Universities who was entirely new to the work, but carried it out with results which were eminently satisfactory. Business generally has grown so that in all departments a wider outlook is necessary. Experience in a particular groove is still of value, but the changes are more frequent, and there must be such mental culture as will enable the operative in a business house to acquire in a short time by observation what has hitherto been acquired in a long time by experience. Whether this mental culture is obtained in a University or elsewhere is immaterial, so long as it is there.

We doubt whether any exceptional agencies are needed to bring together the office and the man. If the student from the University directs his steps to the professions, it is because he sets his hopes upon their rewards. "It is written in the unalterable laws of human nature that no trade shall continue to be at the same time lucrative and easy." Widen the meaning of "trade" to include what are known as the learned professions, and the explanation of the trend of students is simple enough. True, not all exponents of the professions find lucrative employment, but those who strive to enter think not of the average but of the fortunate exceptions. Commerce is becoming more complex, it requires in its votaries a broader culture. The market price will rise and the stream of talent will tend without artificial assistance to fill the vacant places.

Of far greater importance is it that the need for higher education should be recognised, that its acquirement should be within the reach of the many and not limited by reason of its cost to the few. International competition is influenced largely, but not entirely, by education. May we not say that our endowments or our opportunities have stood us in good stead in spite of our tardy recognition of education's advantages? When it is remembered that compulsory education in England dates only from the Act of 1870, it will be seen how much we are behind our active competitors, and how important it is to give every possible encouragement to those who seek to redress the balance. In technical education we have made remarkable strides largely by reason of the developments in electrical and general engineering. The City and Guilds and other similar institutions in London, and their counterparts in the provinces, have done, and are doing, educational work of the highest importance. The qualifying examinations require a fairly liberal general education, and the courses of instruction ensure to any capable and industrious student a training which fits him to embark upon any engineering enterprise. The standard has been raised, and there is no longer any chance for the incompetent or untrained in such work. There are evidences also that this standard of culture is overflowing into the commercial ranks, so that the opportunities for University men to feel any marked superiority, if they ever existed, are becoming less and less. One other change is going on also in commercial circles. It is the endeavour to promote by merit. The tendency may be accelerated with advantage, but it would be a great misfortune if the old-time promotion by seniority were replaced by a favouritism for the product of a particular school. The University man must establish his position, if at all, by his "superior talents and industry and power and weight."

MINING MATTERS.

In the House of Commons recently the Prime Minister said, in reply to a question, "Prices of coal have, no doubt, risen since the passing of the Coal Mines (Minimum Wage) Act," and he might have further said, had he been aware of the fact, that some wages had gone down while others had gone up, the latter, of course, at the expense of the former. As a matter of fact, individual good workmen who had the confidence of the management are, in many cases, earning less wages than they might otherwise have been paid, whilst others have had added to their actual earnings each week a certain sum to make them up to the minimum wages. The minimum wage set up by Act of Parliament forms a standard, and as this can be demanded by the workman, the management cannot be blamed for doing all in their power to see that he gets no more. Wages don't grow on trees, and they must be earned by someone, or they cannot be paid, hence the actual working of the Act results in the good man having to suffer for his poorer mate. We do not think it is likely to be continued after the end of the three years' period fixed by the Act, and there will be, in all likelihood, local disturbances when the rules and rates fixed under the Act come up for revision at the end of the first year.

The Minimum Wage Act was, of course, brought in to cobble up the consequences of the Eight Hours' Act, which was the immediate cause of the men earning less wages. With shorter hours of labour, less coal was produced by the individual workman, and in order to maintain the same output more men had to be employed, but naturally there was —with the same output—the same amount of money to be divided amongst the workmen, and as there were more of the latter, the "portions" were less—which, to say the least, was very disappointing and not at all anticipated by our friend the miner. Hence the Minimum—or "minium," as it is more commonly designated—Wage Act. Really, when one considers the fallacies upon which these two Acts are based, one cannot help thinking that there must be something after all in the pitman's plan for remedying the evils arising from a first "levelling" day, by "levelling" again. The next step in the miner's propaganda is

"five" working days per week, which will have the effect of further raising the price of coal, and following this is "nationalisation" of the coal mines, which latter is fully expected to yield good wages for very little work, if, in fact, any work at all is found to be necessary.

In the report of the Chief Inspector of Mines (Part II) we are told that the Eight Hours' Act is working *fairly* satisfactorily, even in Northumberland and Durham, with the exception that "the cessation of work late in the day on Saturdays still constitutes a grievance in some parts of Durham, and especially in the Cleveland ironstone mining district of North Yorkshire." This, however, is very far from the true state of the case, and it is perfectly well known that the "three-shift system," which is being worked at some of the collieries in Northumberland, is anything but satisfactory to the workmen, and at the present moment the whole county is being "stumped" by the miners' leaders to instigate a strike of all the miners against the system. A ballot is to be taken shortly, and there is a very grave fear that it will be in the affirmative. Durham is expected to follow the lead of Northumberland, so that both counties are involved in this question. The owners affirm that the pits cannot be worked profitably unless there are three shifts of hewers, as the hewers of these two counties only work from $6\frac{3}{4}$ to seven hours, as against the full eight hours in all other districts—hence the difficulty in arranging the working of the mine to suit the difference between the hours worked by the hewers and by those engaged in removing the coal from the workings to the surface, who work eight hours. The owners have offered to do away with the multiple-shift system if the hewers will conform with the Act and work an eight hours' shift, but this reasonable demand they will not for a moment entertain. The Government were fully cognisant of the difficulties in connection with these two counties, as the law did not take effect there until six months after it had become operative in all other districts. The only advantages—if they can be termed such—were the reduction of the hours of the "lads" and "off-hand" men, who, previously to the introduction of the Act, worked from nine to 10 hours, but if they started at six in the morning they left off at four in the afternoon, and every day was the same. Under the Act it is true they work two hours less, but some start at six and finish at two, others start at two in the afternoon and finish at 10 at night, whilst the hewers may be on either day shift or night shift, and the whole of their social and home life is dislocated. The "lads" would readily agree to go back to the 10 hours' shift if they were allowed to do so. What will be the outcome none can say, but certainly the outlook for Northumberland, with its old and nearly worked-out mines, depending solely upon an export trade for its existence, is anything but bright at present. Such is the effect of "pitiful" legislation.

As regards the use of electricity in mines, we are glad to note that this is steadily increasing. Under Rule 15 of the Electricity Special Rules (1905) notices have to be given, when electricity is newly introduced into a mine, to the Inspectors of Mines for the different districts, and 46 such notices were given in 1911, as against 40 in 1910. It is also interesting to note that Scotland takes the lead with 20, and South Wales follows with 13. These rules merely require that notice of its introduction shall be given without any particulars of the plant being asked for, and, as a rule, none are given, but under the new Coal Mines Act, 1911, full particulars are to be given, so that a complete classification of the different systems of distribution, together with a measure of the growth of the use of electricity in mines, will be possible. Such particulars as have been given show that high-pressure alternating-current has been introduced into five mines, medium-pressure alternating-current into 11 mines, medium-pressure direct-current into 13 mines, and low-pressure direct-current into four mines. In the last-named case, however, the current was only used for lighting purposes. The number of electrically-driven coal-cutters in use at the end of 1911 was 998, being an increase of 125 over those in use at the end of 1910.

As regards accidents due to electricity, it is regrettable to notice that 14 fatal accidents were reported to the Inspectors, causing in all 15 deaths. Two of these accidents causing three deaths, however, though reported to and investigated by the Inspector, had, strictly speaking, no connection with electricity in or about mines. There were, therefore, 12 deaths, as against 21 in the previous year, which is very satisfactory indeed. As we propose to deal with these accidents in some detail in a separate article shortly, we need not enter into this question further now, beyond noting that, with one exception which was due to burns following an ignition of gas in a motor room, all the accidents were due to electric shock. The Electrical Inspector of Mines also points out that "the provision of proper connections to earth might have been the means of preventing six of the accidents, or two-thirds of the total number." There were also 41 non-fatal electric shock accidents, many of which were trifling in their results, but in four of the cases the victims were unconscious for some time.

Three underground fires were caused by electricity, exactly the same number as in 1910, fortunately without loss of life, and in another case an explosion of coal dust in a coal crusher house on the surface was traced to the short-circuiting of one of the armature coils, which resulted in excessive sparking. Fortunately, no one was hurt, the building was fire-proof, and no great amount of damage was done. With the introduction of the new electricity rules which came into force on March 9th last in all coal mines, and on September 29th in all metalliferous mines, and which require more care and attention in the installation and use of electricity, a proper earthing system, and a sound mechanical construction of all apparatus, we hope to see electrical accidents—fatalities, at any rate—reduced to *nil*. The number for 1911 is far too great, but it will afford some little satisfaction to know that it represents only *one* per cent. of the fatal accidents in mines due to all causes during the year 1911.

Ghent International Exhibition.—Those responsible for the arrangements for the Ghent International Exhibition have seen to it that fire risk will be at an absolute minimum. They have profited by the lessons learnt from the disastrous fire at the Brussels Exhibition of 1910. There the disaster was largely due to the failure of the water supply, so at Ghent a powerful supply has been installed quite distinct from all other water supplies, and the grounds are mined in all directions by water mains, the largest of which are 300 millimetres, while the greater number are 200 and 150 millimetres in diameter. These mains serve the hydrants scattered throughout the grounds and pavilions. In no part of the whole Exhibition, the authorities state, are two adjoining hydrants more than 50 metres apart, the average distance being considerably less. The water supply is derived from the River Scheldt by means of large automatic pumps at a pressure of five atmospheres, and the hydrants will consequently be capable of throwing water to the top of any of the buildings. That the supply will be adequate in quantity is vouched for by the fact that these pumps can supply 600 cubic metres of water per hour. But the greatest safety from fire lies in the fact that all buildings are isolated, and in no place less than 10 metres apart, while in practically all cases they are much more. A special fire brigade station is also being installed by the municipal fire brigade in the centre of the Exhibition, and equipped with motor fire engines and a staff of 25 men. This brigade will be able to reach all parts of the Exhibition owing to the space between the buildings, and will also be independent of the water supply from the mains owing to the artificial lakes in the grounds. A supply of electric fire alarms connecting with the fire station will also be in operation just as in the London streets, while hand extinguishers will be placed in all buildings. The British Section will have yet another safeguard—and one of the greatest—in the fact that the floors are laid direct upon the ground and all platforms packed with earth, preventing the spreading of fire in the space below the flooring and confining a fire to where it can be reached at once.

Canadian Inquiry.—Among the inquiries relating to Canadian trade recently received at the office of the High Commissioner for Canada, 17, Victoria Street, London, S.W., was one from a Montreal importer, who desires to receive quotations from United Kingdom manufacturers of high-class machinery, iron and steel pipes, and all lines used by steam and electric railways, municipal and other engineers.

D

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

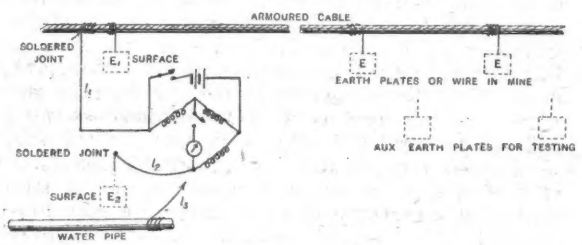
Testing the Continuity of Earth Conductors.

Replying to "Continuity" *re* the testing of earthing conductors and the metallic coverings for continuity, the method of testing depends somewhat upon the arrangement of the earthing system. I presume the metallic covering would be bonded together to give continuity throughout, and the size of the earth conductor would be such as to meet the particular requirements, in accordance with the Home Office rules. Therefore, the only difficulty is in establishing a good "earth" connection, with facilities for testing the same from time to time.

The metallic covering would be connected to a main earth plate at the surface, and also to earth plates or an earth wire at several points in the mine, according to local conditions.

For testing purposes, a second earth plate should be provided at the surface, at a convenient distance from the first. The same should also be done in the mine. Every care should be taken to see that a good earth connection is made.

A bridge test can now be made between the auxiliary earth plates and various points of the earthing system, as



shown on the diagram. If a water pipe is convenient at the surface, a further check can be made.

When making tests, see that all connections are good, and also allow for resistance of lead. The arrangement also allows of a more rough and ready method of testing.

When a good earth has been established, the resistance between the earth plates can be taken periodically, and any rise in the resistance should be noted.

The metallic coverings should have copper bonds across all joints or junctions in the cables, and all connections to the earthing system should be well made.

When permissible, bad joints and connections can be detected by the use of a portable battery and sensitive nstrument, taking the drop across the connection.

B. T. Davies.

Swansea, *February 3rd*, 1913.

The Case of the Sub-Man.

I should like to say a few words in connection with the controversy at present waging in your columns between sub-men and wiremen, also *re* the formation of the A.E.S.E.

Primarily, what would happen if all the present sub-men were to deliver an ultimatum to their chiefs, to the effect that, unless they got a better living wage, they would resign their positions? Supposing their chiefs refused to consider this, which is more than probable, I think the sub-men would find their places filled up almost immediately by competent, well-educated men, whether they be college men or wiremen, well able to adequately carry out all the necessary duties required of them.

Secondarily, on examination of the modern power station and the duties required of sub-men, we find that modern running plant, if kept clean and well oiled, needs practically no attention. Should a fault in it chance to develop, all the education in the world would not prevent it. If of a mechanical nature, then the sense of hearing would probably give the first indication of trouble; by this means also it could be located and then, if possible, rectified. If, on the other hand, the fault is of an electrical nature, then the only means of detecting this would be by daily testing the ohmic resistance of the insulation, this not being a very intricate matter, as it only requires a good sense of seeing, as the ohms and megohms are usually printed accurately on the instrument employed. This may prevent a fault developing, but in the majority of cases does not, as faults have the bad habit of happening unexpectedly.

Now these two senses of hearing and seeing are, as a rule, developed in one man as much as in another, be he a college man or a wireman. After all this comes the ability of the sub-man to keep logs, which, even to the working out of load factors and the plotting of load curves, is not such a very brainy matter. Do not think I am running down the fact of a sub-man having brains; I am only trying to expose the want of scope to employ such brains in such duties. Consequently, my advice is, "If your situation suits you, keep it; if not, you know the remedy."

To put the whole matter in a nutshell, electrical engineering in this country is overcrowded and becoming more so every day, there not being an equivalent outlet in the erection of power stations to hold the surplus.

Transformation.—The A.E.S.E. have, I think, solved the crux of the situation. By forming this association they may eventually improve existing matters considerably; at any rate, at present they will fill a want which is much felt, by allowing an outlet for a considerable amount of surplus brains and energy in the compiling and the discussing of interesting and instructive papers, and thus should go a long way in upholding the subman's welfare and status. Wishing the Association every success,

W. G. R.

Electricity in Agriculture.

You recently published an account of successful results following the application of electricity to farm crops on a farm at Petrovic, near Prague.

It may interest your readers to know that this installation is arranged on the system introduced by ourselves, and that the apparatus used was supplied by us to Messrs. Elektrizitäts Aktien-Gesellschaft (formerly Kolben & Co.), of Prague, who erected the plant, and to whom we are indebted for a confirmation of the report which you have published. They also promise to send us a more detailed report of the results in a short time.

The Agricultural Electric Discharge Co., Ltd.
J. E. Newman, *General Manager.*

Gloucester, *January 31st*, 1913.

The I.E.E. Discussions.

I was interested to read the letter from "Battery" on the above subject in your current issue, and I can quite endorse his remarks.

I was not present at the meeting to which he refers, but I remember an occasion last year, when a member (unknown to me) was speaking, when suddenly the President rose and requested him (I had almost said "ordered" him) to reserve the rest of his remarks till the next meeting, and declared the discussion adjourned. The time was 9.30 exactly, and from the speaker's remarks I think it must have been evident to anyone that another 2 minutes at the outside would have enabled him to finish what he had to say. The member was evidently rather disgusted, and I think it very doubtful whether those remarks were ever concluded.

Personally, I considered the President's abrupt interruption not only very tactless and discourteous, but absolutely rude, as I could not, and cannot, see why he should not have waited a minute or two longer, and adjourned the meeting at the end of the member's remarks.

I have attended a good many meetings of other Societies and Institutions besides those of the Electrical Engineers, both in London and the provinces, but have never seen anything quite the same.

Why this cast-iron "Curtain at 9.30 sharp"?

There is only one conclusion, but those whom we honour by placing in the chair, if bored by the discussion of a subject which does not interest them, might surely ask some other member to take their place.

Omega.

[Without expressing any view as to whether the discussions should be closed at 9.30 or not, we must, in justice to the Presidents of the Institution, emphatically state that in many years' experience of the I.E.E. meetings, we have never known the occupant of the chair to be wanting in courtesy to speakers in discussions. On the contrary, the latter have often been allowed to exceed their fair allowance of time, owing to the reluctance of the chairman to intervene, and we have witnessed many instances in which the speaker, after receiving a gentle hint that his time was up, has continued his remarks in open disregard of the chairman's warning. The discourtesy is on the other side.—EDS. E.R.]

PROCEEDINGS OF INSTITUTIONS.

Independent Steam Condensing Plants.

By W. A. DEXTER.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS *at Leeds, January 15th*, 1913.)

THE author proposes to consider a few of the later forms of surface and jet condensing plant, such as are used in connection with steam turbines driving electrical machinery; he will also deal with various types of air-pumps, both reciprocating and rotary.

From entropy diagrams we find that for the non-condensing engine with steam at 165 lb. absolute pressure, we shall obtain 173 B.TH.U. per lb. of steam; for the engine working condensing we obtain 248 B.TH.U., and where the steam is expanded to a vacuum of 28½ in. we should obtain 334 B.TH.U. per lb. of steam, showing a gain of 43 per cent. and 93 per cent. respectively over the non-condensing engine. These figures represent the theoretical gain, and show the value of expanding steam below atmospheric pressure, and also the great gain in useful work which can be obtained by working an exhaust steam turbine in combination with a non-condensing steam engine.

For reciprocating engines of the low-speed type, such as are very common in the textile mills of this district, there is no doubt that the attached condenser and air-pump is the most efficient type; a high vacuum is not required, say 26 in. at the condenser. For high-speed engines a vacuum of 26 in. to 26½ in. is quite sufficient for economical working. For steam turbines, and especially the low-pressure type, a high vacuum is really essential; but even here it is possible to aim at too high a vacuum for overall efficiency where there is not a good natural supply of cooling water at low temperature.

The most practical and efficient condensers for general conditions are the counter-current surface condenser, the low-level jet condenser, and the elevated self-draining "barometric" jet condenser with air-pump.

The surface type of condenser possesses many advantages over other types, though its initial cost is generally higher. The cost of operating the air and water pumps is lower, due to the fact that the condensing water is kept out of the vacuum chamber of the condenser.

A point which requires careful consideration before deciding on a surface type of plant is the liability to corrosion or pitting of condenser tubes. This may be caused by local electrolytic action, stray electrical currents, &c., and it requires only very slightly acidified condensing water to convey these electrical currents from one part of the tube to another. The author has found this trouble most prevalent where cooling towers are used. In certain cases the first analysis has shown the water to be almost pure and good for drinking purposes, but there has been a very slight acidity, quite sufficient to convey local electrical currents between the different metals forming the alloy of the tubes. Many different mixtures of tubes have been tried with only partial success, and the trouble has in certain cases only been overcome by periodically adding a certain quantity of lime to the water in the cooling tank, sufficient to produce a neutral solution. This corrosion and pitting trouble is also very prevalent where sea water is used for condensing. Zinc and sometimes mild steel plates are fitted into the water chambers of the condenser and connected by mild steel studs to the tube plates, the idea being that these plates will be of negative polarity to the metal of the tubes, and thus be gradually decomposed instead of one of the metals of the tubes.

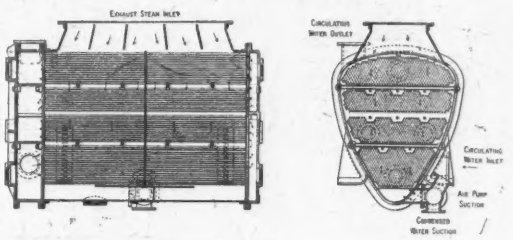


FIG. 3.

The most efficient condenser is one in which the condensing water leaves the condenser at a temperature equivalent to the temperature of the exhaust steam; at the same time the condensed water should be withdrawn at as high a temperature as possible.

In practice it does not pay to aim at so high a discharge temperature for the water, and the best temperature difference between the exhaust steam and discharge cooling water will depend on the inlet temperature of the water. Where there is a plentiful supply of cold water a greater temperature difference should be allowed than where cooling towers are used; also for lower degrees of vacuum, the temperature of the steam being correspondingly high, a greater temperature difference should be taken than for a high vacuum.

The curves in fig. 1 indicate what may be taken as fairly good allowances for temperature difference for various inlet water temperatures and vacua. Thus for 28-in. vacuum, inlet water temperature 75°, the temperature difference would be 8° F., and with water at 50° it would be 19° to 20° F. Fig. 2 is a series of curves showing the ratio of condensing water per pound of steam condensed for different degrees of vacuum and inlet water temperature based upon the temperature differences given in fig. 1.

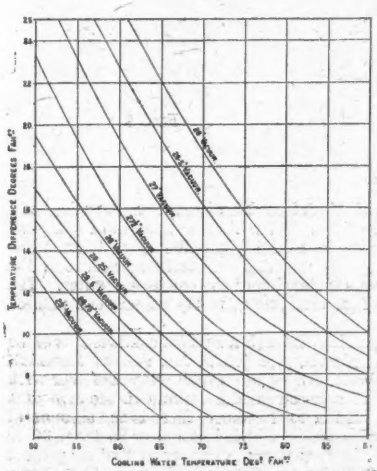


FIG. 1.—DIAGRAM OF TEMPERATURE DIFFERENCE FOR SURFACE WORK.

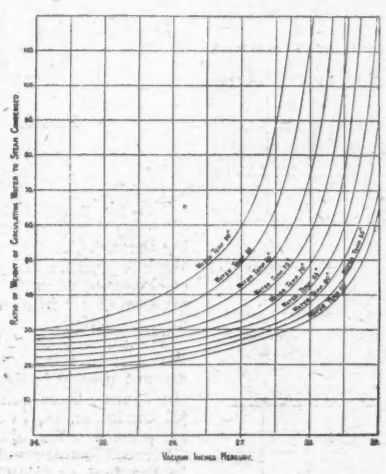


FIG. 2.—DIAGRAM OF CIRCULATING WATER RATES FOR SURFACE WORK.

For a given cooling surface the cheapest form of condenser is certainly one of circular section, relatively small in diameter and long between the tube plates; but it will probably be found that a greater heat transmission per sq. ft. of cooling surface can be attained by a condenser of different shape and design.

The velocity of the steam as it passes through the condenser should be maintained as near as possible to the velocity at the inlet branch. Anything which will retard the flow of steam or cause eddies should be avoided.

The volume of air entering the condenser with the steam is but a small proportion of the total volume of the steam and air, but as the fluid passes through the condenser the steam becomes condensed until at the air pump suction branch or outlet of the condenser, the air forms a very large proportion of the air and vapour mixture, and as the pressure throughout the condenser should remain nearly constant, the area of the path of flow near the outlet may be considerably reduced, leading to a condenser whose cross-section is of wedge or pear-shape.

The steam on entering the condenser should be directed equally over the whole surface of the upper row of tubes, and in its passage through the condenser each square foot of tube surface should condense an equal volume or weight of steam. To obtain this the steam inlet branch should be of large dimensions, following closely the contour of the top part of the condenser body. Plates may be fitted into the distributing chamber to direct the steam equally over the whole surface of the tubes. Except for comparatively small installations, separate air and water pumps give the better efficiency. A condenser approximating to th above-mentioned con-

...itions is shown in fig. 3. In this case the tubes are divided into ...ur nests, and the condensing water is arranged to travel four ...nes through the full length of the condenser.

Three-quarters of an inch outside diameter is the standard used ... most manufacturers for the tubes, but where the water is more ... less dirty, it may be necessary to increase the diameter to 1 in. ...r even more.

Where the cooling water contains a large amount of foreign matter liable to choke the tubes of a surface condenser, or contains salts which would form a scale on the tubes, and thus retard heat transmission, or is of a nature which may cause corrosion or pitting of tubes, or where it is not desired to collect the condensed steam

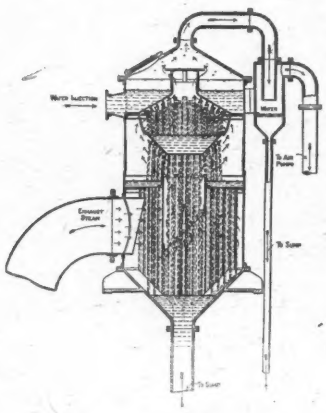


Fig. 4.

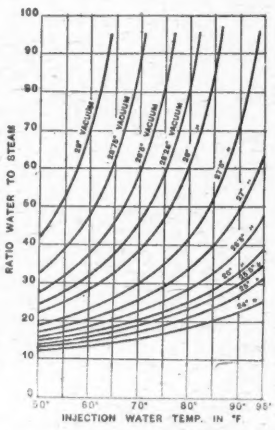


Fig. 5.—Jet Condensers: Ratio of Cooling Water to Steam Condensed at 4° Temperature Difference.

for boiler feed, it would be advisable to adopt a condenser of the jet type. It is a cheaper type of plant as regards initial cost than the surface type, but, generally speaking, requires more power for the operation of the pumps.

In the low-level type, the injection water is usually drawn into the condenser by the vacuum, but it is necessary to withdraw the water from the condenser by means of a pump against a suction resistance equivalent to the vacuum, say, from 28 to 32-ft. head. A separate pump should be used for dealing with the air and incondensable gases. Unless certain precautions are taken, there is a risk of flooding the turbine or engine with this type of plant.

In the barometric type, except in very rare cases, it will be neces-

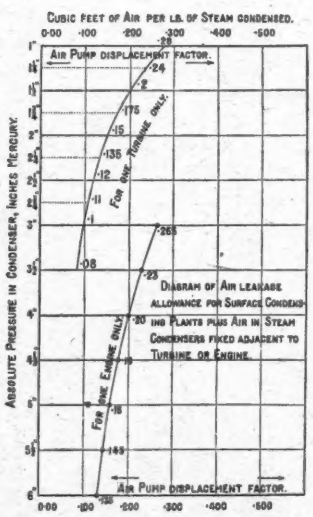

CUBIC FEET OF AIR PER LB. OF STEAM CONDENSED.
AIR PUMP DISPLACEMENT FACTOR.
ABSOLUTE PRESSURE IN CONDENSER, INCHES MERCURY.
FOR ONE TURBINE ONLY.
FOR ONE ENGINE ONLY.
DIAGRAM OF AIR LEAKAGE ALLOWANCE FOR SURFACE CONDENSING PLANTS PLUS AIR IN STEAM CONDENSERS FIXED ADJACENT TO TURBINE OR ENGINE.

Fig. 6.

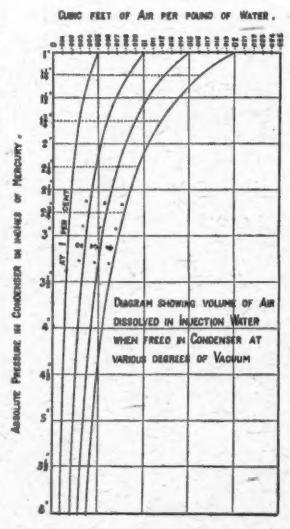

CUBIC FEET OF AIR PER POUND OF WATER.
ABSOLUTE PRESSURE IN CONDENSER IN INCHES OF MERCURY.
DIAGRAM SHOWING VOLUME OF AIR DISSOLVED IN INJECTION WATER WHEN FREED IN CONDENSER AT VARIOUS DEGREES OF VACUUM

Fig. 7.

sary to pump the water into the condenser, but no pump is required to extract the water, as the condenser, being fixed at a barometric height, will be self-draining. The air pump will be the same as for the low-level plant. The pumping power will be smaller for the barometric than the low-level type, as the full effect of the vacuum can be utilised in raising the water to the condenser. It is a safer and easier plant to operate, as, if properly designed, there is no risk of water flooding the exhaust pipe and thence getting back to the turbine or engine. It is more expensive than the low-level type on account of the longer length of steam, air and water pipes required; also, on account of the long exhaust main, it will be necessary to design the plant for a little higher vacuum in order to maintain an equivalent vacuum at the turbine.

The highest heat transmission efficiency will be when the water leaving the condenser is at the same temperature as the incoming steam. This result can be most nearly attained by arranging the steam to enter at the bottom of the condenser, the air and uncondensed gases being drawn off at the top. This gives counter direction of flow for the steam and water; the coldest part of the condenser is at the top and the hottest at the bottom; the water is being gradually raised in temperature during its passage through the condenser.

Fig. 4 shows a section of a vertical type jet condenser fitted with three distributing trays; these trays are perforated with elongated holes about ¾ in. × 2½ in., which give a very good distribution and breaking up of the water, and at the same time allow the use of fairly dirty water. Where the water is very dirty the holes are left out, the trays made shallow or in the form of a flat plate, and the water then falls over the edges in the form of a cascade, suitable openings being arranged in the cascades to allow for the passage of the uncondensed steam and gases. The air is drawn off at the top of the condenser after passing through the coldest condensing water, and is therefore at minimum volume. Where dry-air pumps are used, it is advisable to fit a water separator in the air suction pipe; the water from this separator is drained to the condensing water outlet pipe. With the condenser as illustrated, the author has seen a number of tests carried out under full load conditions where the water has been discharged at a temperature within 1 or 2 degrees of the exhaust steam temperature.

For a good counter-current jet condenser and for the Leblanc multi-jet type with reasonably good air conditions, it is safe to allow for the condensate and injection water being discharged at a temperature within 4° of the temperature corresponding to the vacuum, and in fig. 5 curves are drawn showing the ratio of injection water to steam condensed at various degrees of vacuum and for a temperature difference of 4° F.

The absolute pressure in a condenser is the sum of the pressure corresponding to the vapour tension of the condensed water and the pressure due to the volume of air present in the condenser.

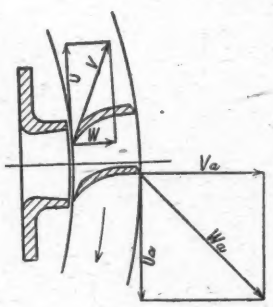


Fig. 8.

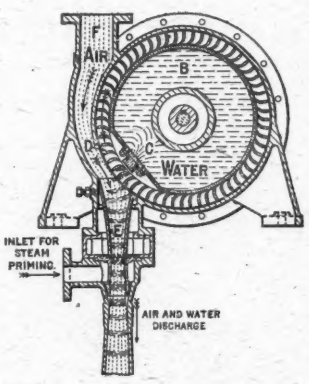


Fig. 9.

The air pump should therefore be of such a capacity and efficiency that it will effectively deal with the amount of air passing through the condenser, in a highly attenuated state or at low absolute pressure, thus closely reaching an absolute pressure in the condenser equal to the vapour tension of the condensed water. The pressure of air in a surface condenser greatly reduces the rate of heat transmission.

The amount of air passing through a surface condenser will be that due to leakage at glands, pipe joints, &c., and to the small amount present in the boiler feed-water which will pass over with the steam; there will be a much greater amount in the case of a jet condenser, as, in addition to the above, there is the amount of air present in the injection water, which latter may be from 30 to 60 times the volume of the feed-water. The amount of air present in the feed or injection water may be anything from 1½ to 5 per cent. of the volume of the water. Particular care should be given towards eliminating air leakage. All pipe joints should be as carefully made as though they had to stand a steam pressure of 300 lb. Low-pressure engine glands should be very carefully packed, turbine glands should be water or steam sealed, the latter being preferable, and for high vacuum it is better to have all valve spindles water-sealed. The exhaust mains, if of cast-iron, should be of close-grained metal, and care should be taken in the fixing of chaplets when casting; piping built of mild steel plates, if well made, makes the best job.

In a high-pressure turbine installation kept in good condition, with the condenser fixed close to the turbine, the air leakage should be within, say, 6 lb. per 10,000 lb. of steam, or the equivalent to what would pass through a 3-mm. diameter expanding nozzle per 22,000 lb. of steam condensed. For a plant connected to a single reciprocating engine, the weight of air allowed for should be that equivalent to what would pass through a 4 or 5-mm. diameter nozzle. Exhaust steam turbine installations require careful attention. The pressure in the engine low-pressure cylinder and the

exhaust main up to the turbine should always be kept 1 to 2 lb. above atmospheric pressure.

In fig. 6, which applies only to surface condensers, curves are drawn representing the actual volume of air to be allowed for at different degrees of vacuum, expressed in cubic feet per pound of steam. The upper curve refers to turbine plants with directly connected condenser, and the lower curve to an engine with directly-connected condenser. If two or more turbines or engines are connected to a central condensing plant the allowances will require to be increased.

The curves are based on a 3 per cent. volume of air in the feed-water and an air leakage equal to a 3-mm. diameter nozzle per 22,000 lb. steam per hour for a single turbine, and a 5-mm. diameter nozzle for one reciprocating engine at the same steam duty. Where more than one turbine or engine is connected to one condenser it is advisable to allow for an extra air capacity in the pump, say 10 per cent. extra for each turbine, other conditions remaining the same.

Referring to the curves, it will be seen that for a single turbine and attached condenser for a vacuum of 27 in., barometer 30 in., an actual air displacement of 0·1 cb. ft. per lb. of steam should be allowed, whereas for a vacuum of 28½ in. it would require 0·2 cb. ft. For a reciprocating engine at 26 in. vacuum it requires 0·2 cb. ft., and for 27 in. vacuum, 0·265 cb. ft. per lb. of steam.

Fig. 7 shows the cubic feet of air to be allowed for at different degrees of vacuum for the air contained in the injection water, and is, of course, applicable only to jet condensers. Four curves are shown for 1, 2, 3 and 4 per cent. volume of entrained air; the horizontal scale is based on cubic feet of air per pound of injection water.

To fix up the size of air-pump for a jet-condenser on the lines indicated, we will take the following example:—

Duty 10,000 lb. steam per hour; vacuum, 28 in. (bar. 30 in.); water, 80° F.

From fig. 5. Injection water	= 60 times the steam.
From fig. 7. 2 per cent. curve at 2 in. abs.	= 0·0054 cb. ft. per lb. water.
Volume of air in injection water (per lb. steam condensed) ...	= 0·324 cb. ft.
Volume of air by leakage (same as for surface plant), fig. 6	= 0·15 cb. ft.
Total per lb. steam condensed	0·474 cb. ft.

10,000 × 0·474 = 4,740 cb. ft. per hour required, or, say, 24 lb. air per hour.

It must not be overlooked that this figure is the actual *volume of air* which must be discharged by the pump, and full allowance must be made for the volumetric efficiency of the type of air pump employed.

The reciprocating wet air-pump with foot, bucket, and delivery valves has mostly been used in the past in connection with low-speed reciprocating engines, and driven directly from the piston rod or cross-head, and has in recent years been almost superseded by the Edwards valveless suction-pump. The principal objection to the former pump is the complication of valves, and especially the inaccessibility of the valves in the bucket. The most notable example of this type of pump is the Weir dual air-pump.

The Edwards pump is so well known that it is unnecessary to describe it. Its main feature is its simplicity, there being only one set of valves, and these being in the delivery plate, they are easily accessible for attention and replacement. The volumetric efficiency of this pump falls rapidly at high vacuum when the air is very attenuated; similarly it drops very much when the speed increases.

Much attention has recently been given to rotary auxiliaries, and especially to air-pumps. In general, the rotary air-pump consists of a centrifugal water-pump which is made to deliver water in jets or sheets through an ejector, the air and gases immediately surrounding these jets being carried along with the water by reason of the friction between the surface of the water and the air in contact with the same. In other cases jets or sheets of water are projected intermittently through passages in the pump casing, entrapping air between the intermittent plugs of water, the whole being discharged against atmospheric pressure by the energy due to the velocity of the water. Experiments have shown that a greater volume of air can be discharged by a given quantity of water when the air is entrapped between plugs or sheets of water than when it is drawn into the ejector by skin friction between the water and air. The velocity of the water being one of the main features of this system, it is essential that it be obtained with the least possible expenditure of power. The features above-mentioned are embodied in the well-known Leblanc pump, invented by Prof. Maurice Leblance, of Paris, about eight years ago.

The author has, during the past few years, carefully investigated a number of the best known forms of rotary air-pumps, the result being that his firm have now taken up a licence for the manufacture of the Leblanc pump, both for land and marine purposes. There are over 12,000 Leblanc installations now at work. They are in successful use connected to steam turbine units of 15,000 KW. capacity. They have been taken up by several of the Continental and foreign navies, and in the French Navy they have practically superseded the reciprocating pump.

A Leblanc pump is essentially a high-vacuum pump, and where very large volumes of air have to be dealt with, the reciprocating type as last described would be the better, but for the very high vacuum required for turbines, it is a most suitable form of air-pump. The characteristic of the Leblanc air-pump is a water ejector, in which the necessary kinetic energy of the water is produced in the apparatus itself by a reversed turbine of partial injection.

Fig. 8 shows a portion of the turbine wheel. The water enters in the turbine with a velocity W, and as the wheel is moving in the direction of the arrow, this velocity, combined with the peripheral velocity U, gives the relative velocity V. This velocity becomes V*a* at the discharge of the turbine, and, combined with the peripheral velocity U*a*, gives an absolute velocity W*a*, with which the water leaves the blades. The angles of the blades are such that the velocity W*a* is about 130 ft. per second. In an ordinary water ejector a head of about 265 ft. would be necessary to produce this velocity. It is, therefore, quite clear that the kinetic energy will be transmitted to the water with a higher efficiency than if this necessary pressure were produced by a centrifugal pump and then transformed into velocity. Also in this arrangement the wheel is running in vacuum, thus reducing the friction losses to a minimum.

Fig. 9 shows a sectional arrangement of the Leblanc pump, which works as follows:—Sealing water is introduced through a suitable branch on the casing into a central chamber B, from which it passes through the water guide nozzle C. On leaving this the water is caught up (or chopped off) by the blades D of the air-pump wheel, or impeller, and ejected into the collecting cone E in the form of thin sheets, which travel with the velocity W*a* until they meet the sides of the collecting cone, and thus form absolutely tight water-pistons, which entrap the air and non-condensable gases coming from the condenser or other apparatus through the suction F, and carry them out against the atmospheric pressure. The estimated thickness of these water-sheets is only from 4 to 8/1,000 of an inch. These sheets have the tendency to enlarge as the water particles are ejected divergently, and, as previously stated, they are concentrated in the collecting cone, forming a compact plug when passing through the smallest diameter into the diffuser, the energy of velocity being converted into pressure, and the plug, consisting of air, gas and water, being discharged against the atmospheric pressure. The great advantage of rotary air-pumps is their extreme simplicity and the small number of moving parts, usually only an impeller and shaft, and being adaptable for direct driving from electric motor, high-speed engine or turbine, all usual gearing troubles are eliminated.

There is no need to dwell in detail on circulating or injection water pumps of the centrifugal type. It is now possible to obtain high efficiencies W.H.P./B.H.P. with this type, and they lend themselves admirably to direct driving from electric motors or small steam turbines.

Steam-driven auxiliaries have a distinct advantage over electrically driven, in that they are not in any way affected by a disturbance of the electric supply. In the case of a single-unit plant the pumps can be started up before the turbine, and a full vacuum obtained in the condenser ready for the starting up of the turbine. This, of course, does not usually apply to a large central power station where there are always one or more generating sets at work.

DISCUSSION.

The chairman (MR. WILSON HARTNELL) said that what Mr. Dexter really meant when he said a vacuum of 30 in. was a pressure of 2½ in. above absolute vacuum. The absolute pressure in inches of mercury could be easily obtained by having a small manometer, instead of measuring the difference of pressures outside and inside the condenser as they usually did.

MR. R. H. CAMPION said he had beautiful water for drinking purposes, but which played great havoc with condenesr tubes. There were a good many bad tubes on the market. The trouble was due to the aerated condition of the water which in passing through the cooling tower absorbed acids which were present in the air. They had earthed the condenser to get rid of electrolysis, and now they were fitting a special arrangement with the same object in view. His experience with the surface condenser suggested that they must not rely on any of these new ideas to do away with tube surface; there was nothing like tube surface. He had plant of the low-level type, which was described as rather unsafe on order, and he did not fear the bad results which the author foretold. As to the risk of flooding, they had two arrangements to prevent that.

MR. DEXTER said that corrosion of the tubes was a very serious matter indeed; he did not agree that it was due in any way to bad tubes. His own firm had had that trouble in many cases. In one case in Glasgow they found the water from the cooling towers was slightly acidified, and the trouble was got over entirely by adding periodically a certain quantity of lime to the cooling water. He had recommended this to a number of people, with very beneficial results. In many cases he had found that the more expensive tubes—particularly those which had been tinned—had given worse results than the inferior tubes had, and he thought it was mostly due to electrolytic action. The neutralisation of the water had the best results. In one case at Liverpool there was a centrifugal pump in which the impeller had been reduced 25 per cent. in weight in less than two months from the pump being installed. When he opened up the pump he noticed a deposit of copper at the bottom of the cast-iron casing in four places diametrically opposite. The pump casing was distinctly magnetised. He found quite a big difference of potential between the pump casing and the spindle, and came to the conclusion that the pump was running like a dynamo. They got over that case by making the whole pump and impeller and spindle all of gun-metal, and of the same mixture of gun-metal, too. They made tests before that, and found that with two different kinds of gun-metal they got quite a rapid corrosion with this water, which was pronounced by the city analyst to be splendid drinking water, and to have nothing wrong with it. They found slight acidity in the water, and since lime had been added to the cooling tower tank they had had no trouble, and they were running the same station with cast-iron pumps and impellers. The

station was divided in two, and the turbines and condensing plant were exactly the same on each side of the station; yet on one side a very large corrosion took place, and on the other side there was no corrosion at all. It was well to remove as much oil as possible before it got to the condenser, as otherwise it would coat the condenser tubes and the cooling towers, and they would soon have a loss of efficiency. The Leblanc type of plant was so safe that he had no fear whatever of using that type either with reciprocating engines or with turbines. If the vacuum dropped the pump did not give up lifting if the sealing tank was placed on the same level as the pump, so that the pump was always primed. Until about 2½ years ago that was a defect in the Leblanc pump.

Mr. A. E. Leigh Scanes said that he noticed a very large temperature difference was given for a low vacuum. In his own opinion, it was never necessary to exceed 15° F.; it meant a quite unnecessary amount of pumping of the water and consequent increase of power. His firm (the Westinghouse Co.) had found, like Mr. Dexter, that the cheapest form of condenser was the circular shell, and he could not agree that any other form was advantageous in the long run, because of the higher initial costs. They found that with that they could obtain results better than, or equal to, certainly any make of condenser on the market of any shape whatever. One of the plants they made recently could condense 22 lb. of steam per sq. ft. with water at 60° F. and a 28½-in. vacuum. Mr. Dexter suggested that directing plates should be fixed under the steam inlet of the condenser. His own firm had found that if that was done there was an appreciable loss of vacuum in the condenser itself, and they found that a large steam inlet, as was also suggested by Mr. Dexter, was quite sufficient in ordinary practice. As to the safety of the low-level jet plants, they had never up to the present had an accident from that cause. They had found that under any conditions where it was possible to put in these Leblanc air pumps they could compete on a commercial basis with the best types of reciprocating pumps. He admitted that the presence of air in the condenser affected the vacuum, but he did not think it affected the heat transmission. Undoubtedly where the air was equally mixed with the steam it did affect the transmission, but it was not equally mixed in a surface condenser. Mr. Dexter suggested that steam-sealed turbines were preferable, but his own opinion was exactly the reverse; whenever they had the steam-sealed plant to deal with they always allowed a ratio of air in the proportion of four to three for what they allowed for water-sealed glands. The great point of the Leblanc rotary pump was that they could get a much higher hot-well temperature, which varied from 5 to 10° F. above that obtained with a reciprocating pump.

Mr. Dexter said he did not quite agree with Mr. Scanes about limiting the temperature differences. When they were working with high-temperature cooling or injection water to obtain a certain vacuum, it was policy to work at a very much closer temperature difference than they need do for a very low water temperature. With regard to directing plates, in one case he found a great improvement made by dividing up the main exhaust pipe, which was of large area, into sections by ribs and carrying these right through to the condenser, and then in the condenser continuing them, so as to direct the steam well towards the end of the condenser, and better results were got thus than by simply fitting the directing plates—much better than without directing plates, and also better than directing plates without the sectionising of the exhaust pipe. He believed there had not been any flooding accident so far with a Leblanc pump. He had been able to get results on low-level type condenser reciprocating pumps showing a temperature difference within one degree, and on several surface condensers he had got to within 1½ or 2 degrees, but these were under exceptional circumstances. In the case of plant where a reciprocating pump was dealing with dry air and a separate pump extracting water, he did not think there was much difference in the hot well temperature compared with that obtained with the rotary plant. He would like to mention the importance of engineers knowing what air capacity was being given to them when they were buying plant. It was very easy to ask for the square feet of cooling surface in a condenser, the quantity of cooling water circulated and power required, &c., but until quite recently he scarcely knew of any specifications issued where the weight or quantity of air which was provided for by the air pump was asked for. It did not matter to the purchaser whether he was getting 3,000 or 4,000 sq. ft. of cooling surface in the condenser unless the condensers were of the same power and of the same design. He had found that in many cases it had paid to give extra cooling surface and go in for a very simple type of condenser. He differed with Mr. Scanes about the air affecting the heat transmission. He thought the results of tests his firm had recently carried out at their works were conclusive on that point.

Mr. McLay said that the obviously commonsense way was to bring the steam in at the bottom, and let it pass up through the condenser, the air being taken off at the top, and the condensed steam at the bottom. They should keep the upper tubes as dry as could be, so that no moisture was taken from the air, and the air would pass over to the pump practically dry. The condenser should be made of a shape suitable to deal with the volume which was going through it, and should be alongside the turbine. If they put their pumps into the basement they got no attention.

Mr. Dexter agreed with the principle of bringing the steam to the bottom and taking it out at the top, but said that did not fit in well with turbine arrangements. He had tried it many times, and it was very difficult to arrange. They had to have foundations; that in itself made a basement in most instances, and they found it was better to put the plant in the basement. Then they could get a much greater output from the same floor space. The basements were as well looked after as the main engine room.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"Consulting Electrical Engineer" writes:—"I should be glad if you would kindly let me know in what position the local authorities stand in the following case: The urban council in question has no electrical powers, and it is questionable whether it will attempt to obtain them. There are several works within the area of the Council, and it is proposed to put an electrical plant in one of them, and transmit power to one or more works about 250 yd. away. An overhead cable would be more direct; but it is deemed best to put an underground cable down along the footpaths, with two road crossings. The streets are side streets, and the roads and footpaths unmade and unattached. An application has been sent to the Council for permission to carry this cable as suggested; it is believed that the Council is going to object. Would you kindly state whether it is entitled to object, seeing that it has no powers, nor is it likely to acquire them in the immediate future. If the roads are unattached and the owners of the roads be agreeable, could a cable be laid in spite of the Council? The writer would be obliged for an early reply to these and any other points which may cover the case.

*** This query would appear to raise a question under Sec. 23 of the Electric Lighting Act, 1909, which, so far as is known, has not yet been considered by any court of law. A glance at that section, however, shows that it confers no right upon a local authority to interfere with the private supply of electricity unless that authority is itself supplying electricity under licence or provisional order. Moreover, although it enables a supply authority, being a local authority, to interdict the supply of electricity, it does not "prevent any company or person from affording a supply of electrical energy to any other company or person, where the business of the company or person affording the supply is not primarily that of the supply of electrical energy to consumers." It would therefore seem that so far as the Act of 1909 is concerned, the Council has no power or authority to interfere. A more serious question arises, however, with regard to the laying of underground cables. By the exercise of its powers in this respect, the local authority may effectually check the proposed enterprise. The Public Health Act, 1875, Sec. 148, vests "all streets, being, or which at any time become, highways repairable by the inhabitants at large within any urban district, and the pavement stones and other materials thereof in the urban authority." A similar provision applies to the Metropolis; and where an electric lighting company had illegally broken up the surface of a street within the district of a Vestry in the Metropolis and placed their pipes and wires at a depth of about 2 ft. below the surface, it was held that the Vestry was not, by virtue of Sec. 96 of the Metropolis Management Act, 1855, the owner of the soil of the street at that depth, and that, although the company had acted illegally in breaking up the street, and an injunction was granted restraining them from doing so again, the Vestry was not entitled to a mandatory injunction to compel the company to remove their pipes and wires, there being no continuing trespass upon, or interference with, any right of the Vestry (Vestry of St. Mary, Battersea *v.* County of London, &c., Co., Ltd., (1899) 1 Ch. 474). For the unwarranted breaking-up of the street, however, the company were summoned at the police court and fined. The suggestion may be thrown out that if the soil of the streets in question does not belong to the Council referred to, there will be nothing to prevent wires or cables being suspended at such a height as not to interfere with the traffic. If, therefore, the necessary wayleaves from frontagers and others can be obtained, there is no reason why an overhead system should not be adopted, provided the Public Health Acts Amendment Act, 1890, (if it has been adopted in the area in question) is complied with. Before embarking upon this course, however, a solicitor should be consulted, because the question whether the "soil" of the streets is vested in the Council is highly technical, and cannot be answered without a much fuller statement of the facts than that which is given in the query.

British and American Electrical Machinery Exports.

—In Saturday's Parliamentary Papers Mr. Arnold asked the President of the Board of Trade to state what were the values of the exports of electrical machinery from the United Kingdom and from the United States from 1903 to 1911, inclusive; and what were the values of the imports of electrical machinery of United States manufacture into the United Kingdom during the same years.

Mr. Sydney Buxton, in reply, furnished the following statement:—

Year.	Exports of "electrical machinery of all kinds" to all destinations. From the United Kingdom.	From the United States of America.	Imports into the United Kingdom of electrical machinery of all kinds from the United States of America.
1903	£437,000	£1,064,000	£306,000
1904	523,000	1,391,000	290,000
1905	644,000	1,544,000	203,000
1906	842,000	1,724,000	259,000
1907	996,000	2,028,000	186,000
1908	1,354,000	1,449,000	161,000
1909	1,432,000	1,242,000	162,000
1910	1,603,000	1,491,000	153,000
1911	1,791,000	1,739,000	195,000

BUSINESS NOTES.

The Edison Car Lighting System.—In connection with our recent article on the subject of car lighting dynamos, as shown at the Olympia Motor-Car Exhibition in November last, Mr. John F. Monnot, of 41, Great Portland Street, W., the sole concessionnaire for the Edison battery, has brought to our notice an electric lighting system for motor-cars which he has introduced, in which the necessary supply of current is furnished by a battery of Edison accumulators, the use of a dynamo being dispensed with. The lighting set comprises a small Edison nickel-steel storage battery, two side lamps, a tail lamp, and a two-way switchboard. Four sizes are being made, the No. 1 set, which is intended for small cars, comprising a 40 ampere-hour 4-volt battery, three lamps, switchboard, and three 4-volt 4-c.p. metallic-filament bulbs, and being designed to give 13 hours' continuous lighting on one charge. The No. 2 set is also for small cars, and differs only from the former in having an 80 ampere-hour battery, for 26 hours' continuous lighting. The No. 3 set is for medium cars; the battery in this case is of 40 ampere-hour capacity at 8 volts, 4 c.p., 8-volt bulbs being used. The largest set is adapted for big cars, and is able to furnish current for 50 hours' continuous lighting on one charge, the battery having a capacity of 80 ampere-hours at 8 volts. In addition to lighting the lamps, the battery may be used for the operation of an electric horn. The different sets are neatly arranged, and where a supply of current for charging purposes is readily available, they will be found a much simpler and certainly less costly car electric lighting equipment than where dynamos are used. At the same time, the latter have the advantage that no special battery charging is necessary, this being automatically effected.

Catalogues and Lists.—Messrs. Gent & Co., Ltd., Faraday Works, Leicester.—Two pocket leaflets; No. 510 illustrates and gives prices, &c., of bells for power circuits, while No. 511 deals similarly with the "Electromatic" C.B. interphone system, and contains a diagram. Contractors can have quantities of either with their names printed thereon.

The Sterling Telephone and Electric Co., Ltd., 200, Upper Thames Street, London, E.C.—The company have, owing to the demand, decided to reinstate in their catalogue, and to stock in London, their cream and gold "Twencen" domestic telephone No. U100, which they withdrew when issuing the eighth edition of their catalogue. They have now prepared for insertion in this catalogue a suitable priced leaflet relating to the instrument.

The "Safetee" Controlling Appliances Co., Ltd., Luton, Beds.—Six-page illustrated price list, with particulars of parts of the "Safetee" combined switch fuse for 1 to 500 amperes and for 250 and 500 volts.

The Universal Electrical Manufacturing Co., 14, Station Road, Queen's Road, Peckham, London, S.E.—Folding pocket card with calendar for the first quarter of the year followed by particulars and illustrations of the "Poplar" street lighting fitting.

The Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.—New catalogue, No. 1,071 (32 pages), containing a full description of the Sturtevant system of mechanical draught for steam boilers. The pamphlet is fully illustrated with half-tone views of the system applied to a number of power stations and other works; also line drawings of typical arrangement of the economiser and system.

Messrs. Veritys, Ltd., London and Birmingham.—Publication No. 682, consisting of 16 pages of illustrations, notes and prices of "Aston" watertight fittings for outside and industrial service, ship installations, porcelain acid-proof fittings, inverted reflector fittings, &c.

Messrs. J. Waddington & Son, builders and electrical fitters, 6 and 7, Creed Lane, Ludgate Hill, E.C., have sent out a useful little desk calendar, with framed monthly slips, a complete year appearing on the back.

The Record Electrical Co., Ltd., Caxton House, Westminster, London, S.W.—Twelve-page catalogue (M 10), containing a full and illustrated description, and table of prices, of their new moving-coil instruments for direct current. Also a collection of illustrated price lists in binding cover, particularising their auto-battery cut-in and cut-outs, circuit-breakers, moving-iron and moving-coil instruments for A.C. and D.C., and switchboard and portable shunts.

Messrs. Bedford, Steer, End & Co., Ltd., 78 to 84, Long Lane, Borough, London, S.E.—Price leaflet relating to asbestos woven wire resistance nets.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Leaflet (S 1,514) giving prices of Osram candle lamps (plain and twisted flame, and "Spearhead"). Eight-page catalogue (No. F 1,660) containing illustrations and prices of a number of designs of Holophone pendants for direct, indirect and diffused lighting.

The Armorduct Manufacturing Co., Ltd., Farringdon Avenue, London, E.C.—A two-colour folder, showing by means of outline maps the extent of an order recently received from the Postmaster-General of New South Wales for Armorduct vulcanised rubber cable (1,115 miles).

The Westminster Tool and Electric Co., Suffolk House, Laurence Pountney Hill, London, E.C.—Illustrated price leaflets relating to the Westminster electric grill, No. 6 electric cooker (oven, grill and boiling plate), and the No. 3 cooker.

Mr. C. M. Simpson, Canada House, Baldwin Street, Bristol.—Neat little calendar for 1913, with monthly slips.

Mr. H. C. Slingsby, 142-146, Old Street, London, E.C.—Large sheet of illustrations showing a marvellous collection of a thousand different ladders, trucks, tower wagons, hand-carts, and other such things.

The Ebonestos Manufacturing Co., 127, Pomeroy Street, New Cross, London, S.E.—Advance copy of a new catalogue of moulded insulators. Considerable additions have been made to the number of standard sizes of bushes and handles, all of which can be delivered from stock. The firm have made considerable reduction in the prices of most of their standard articles. In order to encourage the trade to keep to as small a number of standards as possible, a selected number of bushes printed in black are offered at greatly reduced prices. The catalogue opens with particulars of tests, and the following sections, which are separated by a thumb index, contain dimensioned full-size sketches of bushes of different kinds, handles, sleeves and washers, caps, terminals and brushholders, and hand wheels. A loose list shows and prices insulated lampholders, and a £50 free insurance against death from electrical shock is available for anybody who may be using inferior insulators.

The Wandsworth Electrical Manufacturing Co., Ltd., Imperial Works, Ludgate Hill, Birmingham.—Seventy-two-page catalogue containing descriptive notes, prices, and very clear illustrations of a variety of switchboards, tumbler switches, ornamental switch-covers, secret switches, combination switches and plugs, two-pin floor and wall sockets and plugs, adapters, cut-outs, fuseboards, main fuses, spring-contact switches, knife switches, ironclad switches, and so forth.

Siemens Brothers Dynamo Works, Ltd., Caxton House, Westminster, S.W.—Twelve-page pamphlet containing a list of their lantern slides that are held in stock. Since the first issue of this list it has been revised and considerably increased by the addition of many interesting and up-to-date slides, and now consists of 238 different views. The slides are kept in stock at Caxton House, and are loaned free of charge to lecturers, schools, &c.

Messrs. Siemens Bros. & Co., Ltd., Woolwich.—New catalogue (No. 529) of eight pages and cover, giving full descriptive notes, with prices and illustrations, concerning their small and large electric motor syrens for ordinary and for sharply defined signals.

Trade Announcements.—Messrs. Steinbach and Hohn, 669, Mansion House Chambers, Bucklersbury, London, E.C., have been appointed sole agents for the United Kingdom for Messrs. Lindner & Co., of Sondershausen, manufacturers of electrical porcelain ware and fittings.

The M.A.N. Maschinenfabrik Augsburg-Nurnberg A.G. announce that owing to increased business they are this week moving from their offices in the East Block of Caxton House to a larger suite of offices on the first floor of the West Block in Caxton House.

Mr. E. Allen, formerly manager of the Central Electric Co., has started in business for himself under the title of E. Allen & Co., electrical engineers and contractors, at 138B, Newington Butts, London, S.E. Lists and catalogues from the trade are asked for.

Messrs. Grant & Evans, electric bell fitters, &c., of 41, Bridge Street, Berwick-on-Tweed, have opened a branch establishment at Market Place, Coldingham.

On Monday last Messrs. Mann, Egerton & Co., Ltd., of Norwich, removed their electrical offices from 82, Victoria Street, Westminster, to 379-381, Euston Road, London, where they have taken extensive premises for their motor-car and electrical staff. The firm obtained additional accommodation owing to the increase in their electrical and motor-car business in London.

Mr. S. J. Bradwall, electrical engineer, of Macclesfield, has removed from Duke Street to more commodious premises at Lowe Street, Park Green.

Mr. L. A. Wells, late electrical contractor, of 19, St. Margaret's Street, and Parade, Canterbury, has disposed of his business, and is leaving for Sydney by the *Orama* on the 14th inst. He will be pleased to receive all correspondence, especially catalogues from sign specialists, at G.P.O., Sydney, New South Wales.

The District Iron and Steel Co., Ltd., Smethwick, have appointed Mr. F. S. Rippingille, of Winchester House, Birmingham, as their representative for the specialities manufactured in their electrical conduit department, which comprise close-joint conduit and electrically-welded screwed conduits, clips, saddles, couplers, &c.

Private Arrangements.—Hammond & Champness, Ltd., Alfreton Street, Old Kent Road, London, S.E.—The creditors interested herein were called together on Tuesday, at the Great Eastern Hotel, Liverpool Street, E.C., when a statement of affairs was presented, which had been prepared by Messrs. Henry J. Burgess & Co., 14, St. Mary Axe, E.C., showing the position as at January 17th last. This disclosed liabilities of £7,656. The assets were valued at £4,525. Mr. Burgess reported that he had been appointed to act as the voluntary liquidator of the company, and also as the Receiver on behalf of the debenture-holders. The assets had not been taken on a realisation basis, and at a forced sale they might not realise the amount at which they were set down. All the debentures were issued for cash. The company was registered in March, 1910, with a nominal capital of £4,000, divided into 3,700 preference shares of £1 each, and 6,000 ordinary shares of 1s. each. The total number of shares taken up was 603 preference shares, and the 6,000 ordinary shares of 1s. each had also been issued. All those shares were fully paid up. A creditor said he understood that the cash claims were in respect of moneys advanced to the partnership by the partners,

and the debts were taken over by the company. The liquidator replied that there were cash creditors who had never been partners in the concern, while the directors were now creditors for a larger amount than at the formation of the company. A solicitor, who appeared for the cash creditors, intimated that all those claims would be withdrawn, and a document to that effect was produced at the meeting. In answer to questions, the liquidator stated that the first balance-sheet prepared was at September, 1910. It covered a period of 15 months' trading, including nine months of the trading of the business before the company was registered. During that period there was a loss of £292, while in the succeeding 12 months there was a loss of £1,450. During the 12 months to September, 1912, the debit balance was increased to £2,100. Mr. E. H. Hawkins pointed out that ever since the company had been formed it had carried on business at a loss. In answer to questions, it was stated that in the last balance-sheet the goodwill of the company was set down as £700, but in the statement of affairs no value was placed upon it. Mr. Burgess added that he had been carrying on the business and had completed some small contracts. He could offer the business for sale as a going concern, and if that was not successful he could attempt to dispose of the assets under the hammer. The opinion was expressed by certain creditors that application should be made to the Court for the appointment of an independent liquidator. A motion to that effect was, however, defeated, and it was decided to appoint a committee of six of the principal creditors to act with Mr. Burgess in the liquidation of the company. The following are the principal creditors :—

Adams British Oil Co.	£16	General Electric Co.	£36
Aston Construction Co,	154	Hoffmann Manufacturing Co.	50
Auto Machinery Co.	40	Knights, H. Newton & Co., Ltd.	174
Aldous & Smith	45	Lift and Hoist Co.	16
Bergtheil & Young, Ltd.	40	Macnamara, J. J.	17
Buckley, S.	48	Marryat & Place	28
Brotherhood, P., Ltd.	49	Mawdsleys, Ltd.	197
Bellows, J.	40	Mosers, Ltd	112
Butler & Jordan	20	Nash, W.	82
Balmforth, T., & Co.	126	Nettlefold & Sons	30
Brotherton Tubes and Conduits, Ltd.	31	Oliver Arc Lamp Co.	46
Croggon & Co., Ltd.	16	Potter, F. W., & Co.	55
Couldray, W.	15	Redpath, Brown & Co.	100
Cohen, J., & Co.	21	Reid Gear Co.	65
Dixon & Corbitt and R. S. Newall & Co., Ltd.	80	Rodney Foundry Co., Ltd.	147
Electric Control, Ltd.	55	Russell, J., & Co., Ltd.	22
Geipel, Wm., & Co.	63	Smith, A. J., & Co.	241
		Sewell, Edwards & Nevill	28
		Varley Magnet Co.	30

Bankruptcy Proceedings.—Samuel Lord, director of a limited company, 18, James Street, Liverpool.—This debtor attended at the Court House, Government Buildings, Victoria Street, Liverpool, on January 27th, for his adjourned public examination, before Mr. Registrar Howarth. The Official Receiver said he had no further questions to ask. Although he was not satisfied with the information he had obtained from the debtor, he did not think he could carry the matter further. Mr. Ross, solicitor, said that the debtor had given all the information in his power, and as no good purpose would be served by keeping the matter open, he asked that the public examination should be closed. The Official Receiver said he would not oppose the closing, as he was not prepared to proceed further at present. The examination was ordered to be closed.

Wesley Sutton, 62, Dale Street, Liverpool.—This debtor also attended on January 27th, before Mr. Registrar Howarth, for his adjourned public examination. The Official Receiver made the same observations as in the above case, and the examination was ordered to be closed.

Chas. Lewis, electrical engineer, lately licensed victualler, Old Trafford.—Receiving order made at Manchester on January 29th, on debtor's own petition. First meeting, February 12th ; public examination, February 21st.

Patents Applications.—The Economic Engineering and Construction Co. have applied for the restoration of patent No. 8,328, of 1907, granted to E. M. Bassler, for "Improvements in and relating to Conveyors."

An order has been made restoring patent No. 22,968, of 1904, granted to H. H. Lake for an invention communicated by the Oil and Waste Saving Co., of U.S.A., for "Improvements in Centrifugal Machines."

Finding Lost Pipes.—We regret that in our issue of January 24th the address of the English makers of the wireless pipe locater was incorrectly stated. The firm is that of Messrs. Edwin A. Mansfield & Co., 12, Beckenham Road, New Brighton, Cheshire, and all applicants will receive full particulars on application.

Dissolution.—Wheeler & Murphy (J. E. Wheeler and W. Murphy), electrical engineers, Northwood.—Partnership dissolved ; Mr. Wheeler attends to debts.

LIGHTING and POWER NOTES.

Aberdeen.—In view of the proposal to supply electricity to Banchory and Ballater and intermediate places on Deeside, Mr. Bell has been authorised to visit districts where overhead transmissions are in use.

The Electric Lighting Department is to apply to the Secretary for Scotland for borrowing powers for £80,000.

Accrington.—An application has been received by the Electricity Committee from Messrs. Peebles & Co., of Rishton Paper Mills, for a minimum electrical supply of 1,000,000 KW. hours per annum. This has been referred to the sub-Committee for consideration, with power to agree to terms. A contract has been entered into for a supply of electrical energy to the Accrington Brick and Tile Co. for a period of three years.

Alderman Higham, the chairman of the Electricity Committee, last week forecasted an early reduction in the price of current for lighting. The experiment of generating electricity by the Mond gas system, said Alderman Higham, was proving a success, and the tabulated results would doubtless be eagerly awaited and keenly criticised by electricity experts throughout the country. Quite a number of people interested in the cheap production of electricity had visited the electricity works since the plant was started.

Athenry.—The proposed improvements to be effected in this town include an electric lighting scheme, to cost £2,000.

Bewdley.—At a meeting of the T.C. on Monday, it was announced that negotiations were proceeding for the establishment of electric light works in the town by a private company, who would give the Corporation the option to purchase the undertaking at stated intervals. The Mayor stated that the negotiations, although not yet completed, were in a very forward state, and there was every likelihood of the scheme being carried through.

Bolton.—An inquiry was held on January 30th, on behalf of the L.G.B., relative to the T.C.'s application for sanction to borrow £130,000 for carrying out a big extension scheme in connection with the electricity undertaking, including the erection and complete equipment of a generating station on a site known as Back-o'-th'-Bank. The town clerk said that the land had already been acquired. In consequence of alterations made in the scheme, the actual amount now estimated to be required was £122,000.

The scheme, for which the borough electrical engineer, Mr. A. A. Day, is responsible, has been deemed necessary by reason of the fact that the existing power station at Spa Road has become inadequate. The initial capacity of the plant proposed is two 4,000-KW. turbo-alternators generating three-phase current at 50 cycles and 6,500 volts. Coal will be delivered from the L. & Y. Railway siding direct on top of the boiler house, and on the other side of the site is the River Tonge, the water of which will be available for condensing purposes. In addition to the river, there will be extensive reservoir capacity for condensing purposes.

The Inspector said if the Board approved the general scheme, subject to future details being satisfactory, it would fix a limit to the expenditure.

Canada.—The Carillion Falls, on the Ottawa River, 35 miles from Montreal, will be the source of power of the National Hydro-Electric Co., with a capital of $1,000,000, which will seek a market in Montreal for the 148,000 H.P. which could be developed from them.

The immense water-power of the river St. Lawrence, above Montreal, is a source of great temptation to speculators and others on both sides of the Canadian border. Another attempt is to be made to convert the possibilities of the river into an electric development proposition. The promoters of this scheme are the Canadian Light and Power Co. Application has been made some time ago to the Government at Ottawa for authorisation to build dams across the river near Coateaw, at the head of the rapids, and at the entrance to the Cedars. Works involving from $15,000,000 to $20,000,000 are projected, in addition to those already under construction at the foot of Beauharnais Canal. The scheme, it is understood, will provide for the production of close to a half-million horse-power within easy reach of Montreal.

Caton (Lancs.).—An effort is being made to establish an electric light undertaking at Caton. Efforts are being made to ascertain the probable number of consumers, and if there is a sufficient demand, steps will be taken to supply it.

Christchurch.—The B. of G. has decided to take a supply of current from the Bournemouth and Poole Electricity Supply Co., for at least five years, at 3½d. per KW.-hour for lighting, and 1½d. per KW.-hour for power and heating.

Continental Notes.—Belgium.—La Société Belge Popp (Traitement des Métaux par l'Électricité) is the name of a new company which has just been formed in Brussels with a capital of £50,000, to establish a plant for the electrical treatment of metal in accordance with certain patented processes.

Spain.—The municipal authorities of Sarria (province of Lugo) have just invited tenders for the concession for the electric lighting of the town during a period of 10 years.

Germany.—The Ostharz Ueberland Zentrale Gesellschaft is the name of a new company which has lately been formed at Dessau, with a capital of £50,000, to establish a central electricity generation station for the supply of current for lighting and power purposes to a number of small towns and villages in the East Hartz district.

Sweden.—The new Swedish budget makes provision for the following electrical works and acquisitions for the State railways and power stations, &c. :—For the frontier railway, additional electrical equipment £30,555, and £22,222 for 1914 ; continuation of the works at the new Trolhattan canal, £166,666, including £5,277 already voted from the widening of the Stallback canal ; extensions at the Trolhattan power station, for a first and second outbuilding, £7,222, and for a third building £8,888, with £7,222 for extras ; for electrical plant at the Trolhattan power station £8,333 ; continuation of works at Porjus

power station, £44,000; and for increasing the water storage capacity of the Store Lule river £4,000; for the Alfkarleby installation £159,000, besides a like amount for the transmission network from stations.—*Affarsvarlden.*

Derby.—The E.L. Committee of the T.C. has recommended an application to the L.G.B. for a loan of £13,500 for additional plant, &c., viz., 2,000-KW. turbine set, with condensing plant and foundations, £9,000; rotary converter and transformer, £1,000; motor-generator, £2,500; switchgear, £750; cable work and sundries, £250.

Douglas.—At a special meeting of the T.C. it was decided by a majority of 3 votes to secure an estimate for a scheme of decorative electric lighting for the promenades of South Douglas, the cost not to exceed £12,000. An amendment to obtain a report on a similar scheme at half the cost was defeated. Another motion rescinding the previous decision empowering the Council to take a plebiscite of the town on an enlarged scheme to cost £28,000 was carried. It was pointed out that no Act provided for a plebiscite on electric lighting, and the Council would be liable to be surcharged with the cost.

Dover.—The sanction of the L.G.B. is to be obtained to the borrowing of a further £300 for transformers.

Dudley.—The Electric Lighting Committee is making necessary recommendation to the Council for the purpose of carrying on the generating station until such time as the works are handed over to the Electric Traction Co. and co-operating firms, in accordance with the deed of sale. Mr. C. E. Savage, the electrical engineer, has accepted another position near Dudley, but the Committee advises the Council to ask him to devote half or two-thirds of his time to the work of station engineer at the rate of £25 per month until the transfer. It is further recommended that the services of Mr. Savage be retained after the date of the transfer, at an annual fee of £21, for the purpose of inspecting the cost and quantities consumed on the street lighting contract, and for the examination of the tramway plant under the lease.

Dundee.—Messrs. Mather & Platt are fitting a factory in the centre of the city with three-phase motors, and those already connected to the Corporation mains are giving every satisfaction. Individual drive on the Schorch system has been adopted at a factory in the Lochee district, which is connected to the Corporation mains.

Durham.—The R.D.C. has decided to have the electric light installed at Honghal Hospital, where oil lamps are at present in use.

Edinburgh.—At a meeting of the Corporation Electric Lighting Committee, it was agreed to advise the T.C. to give a direct electric supply to Redford Barracks, conditional upon the consent of the county authorities being obtained. A proposal to give a supply to Duddingston was remitted to the engineer for report, and a Sub-Committee was appointed to consider the question of opening showrooms for the purpose of exhibiting electrical fittings and apparatus, and demonstrating their utility.

Eccles.—At a recent meeting of the E.L. Committee, particulars were given as to the annual amount of electrical energy which the Salford Corporation would agree to take for its tramways, and its willingness to agree to a "coal" clause, whereby a rise or fall in the price of coal would be reflected in the price of energy.

Glasgow.—At the last meeting of the Electricity Committee, the engineer reported that the consumption of coal at the generating stations, and the output of electricity had largely exceed.d his estimates, and a special sub-committee has been empowered to purchase such additional quantity of coal as may be considered necessary.

The T.C. at its first meeting is to be asked to approve of a proposal by the sub-committee for the holding of an exhibition of electrical apparatus in the city at a date probably in the late autumn, and to empower the committee to make the necessary arrangements. Mr. James Freer, who managed the last two smoke-abatement exhibitions, is proposed to manage the latest venture, which was brought about on the invitation of several manufacturers and agents.

Gloucester.—The B. of T. has granted a licence to enable the T.C. to supply electricity to the Children's Hospital at Longford.

Hertfordshire.—Petitions are to be lodged by the C.C. against the following Electric Lighting orders:—Watford (Extension), Barnet (Extension), Colne Valley, Rickmansworth, Chlorleywood and District, and the Northwood and Ruislip (Extension).

Heston-Isleworth.—In respect of mains and house services, two further loans of £1,200 and £800 are to be applied for by the Council.

Hornsey.—To-morrow the Council's new plant at th generating station is to be inaugurated. This consists of a 750-KW. Belliss-E.C.C. direct-current set, with a speed of 250 R.P.M. The engine is of the triple-expansion type, and exhausts to a Mirrlees barometric condenser with two Rees-Roturbo pumps driven by a Bruce Peebles motor for supplying condensing water. A Baker oil separator is provided, and the hot well water is passed through a softening apparatus to the boiler feed tank, in connection with which a Rees-Roturbo electrically-driven boiler feed pump has been installed. A Babcock water-tube boiler was installed about 12 months ago, and a further boiler of the marine type, with electrically-driven stoker gear, coal bunkers, &c., has been added, while the engine room has been extended sufficiently to accommodate two further large sets, in addition to that just installed. The work has been carried out under the direction of the borough electrical engineer, Mr. Norman Staniland.

Ilford.—Application is to be made to the L.G.B. for sanction to borrow £10,000, being the estimated expenditure on mains extensions during the next three years. The amount is made up as follows:—Private mains, £5,500; public mains, £1,000; house services, £3,500; legal and loan charges, £100. A supply is to be given to the Omnibus Co., at its new garage at Seven Kings, on the two-rate system.

Kislingbury (Northants).—A meeting of the ratepayers has passed a resolution supporting a proposal to obtain a supply of electricity from Northampton through the Electric Light Co., and pledging them to become consumers when a supply is available.

Lewes.—An 80-ft. chimney stack fell on Monday night on to the local electricity works, doing considerable damage.

Liverpool.—Applications are to be made to the Board of Trade and the L.G.B., for sanction to the borrowing of £8,000 and £40,000 for the provision of additional tramway cars and electric mains, respectively.

London.—HAMMERSMITH—The Mayor and members of the Council last week paid a visit to the electricity works in Fulham Palace Road. Particular interest was taken in the last turbine installed, which was supplied by Messrs. Richardsons, Westgarth & Co. It has a capacity of 3,000 KW., with 3,750 KW. in case of emergency for two hours. In the works there are now nine machines, viz., four turbines and five high-speed reciprocating generators, the total capacity of the whole being 10,300 KW.

The sum of £3,000 is to be taken up from the L.C.C. for electricity purposes, viz., £1,239 for mains, repayable in 25 years; £138 for switchgear, within 15 years; £1,324 for house services within 12 years; and £299 for meters within 10 years.

Maidstone.—The T.C. has adopted the recommendation of the Electricity Committee to extend the plant and buildings at the electricity works at an estimated cost of £5,620.

Middlesex.—With the view of protecting the county interests, a petition is to be lodged against the Metropolitan Electric Tramways (Railless Traction) Bill, 1913. Objections have been lodged against the Colne Valley Electric Supply Prov. Order and the Wood Green Electric Lighting Prov. Order.

Newport (Mon.).—As an experiment, the Borough Education Committee has decided to have the electric light installed in the Bolt Street and Eveswell schools.

Oldham.—A point in connection with the proposed new plant at the electricity works was raised at a meeting of the Corporation Electricity Committee last week. Councillor C. Hardman said that a local firm had asked if the Committee could let them have 1,000 H.P. The Committee had intended to get a 1,500-H.P. set, and that might be too small in view of the many applications. The engineer (Mr. Newington) said a 2,000-H.P. set was slightly more economical than the 1,500 H.P. set. The working cost was practically the same, and the present boiler power would be sufficient. It was decided that the Committee should put a 2,000-H.P. set in the application for borrowing powers which is to be made, instead of the 1,500 H.P. set, as first suggested; also to ask permission to supply a Royton firm, which is just on the border.

Plymouth.—The Electricity Committee of the T.C. has decided to extend and alter the plant and mains at the electricity works, at an estimated cost of £7,500. Of this £2,000 for alterations will be met out of the reserve fund, and a loan will be applied for, for the balance of £5,500.

Rickmansworth.—The U.D.C. has decided, for certain reasons submitted to the B. of T., not to support the application for a prov. order for electric light of Mr. R. E. H. Fisher, who had asked the B. of T. to dispense with the Council's consent. The Watford R.D.C. has also taken a similar attitude, and has informed the B. of T. that it cannot support the application of any particular electrical company.

St. Albans.—The B. of G. has appointed a Committee to go into the whole question of lighting the workhouse at present lit by gas.

Salford.—An agreement has been entered into with the Calico Printers' Association for supplying energy to them, subject to a minimum payment being guaranteed, and to the payment of £1 per quarter per H.P. demanded, and ½d. per KW.-hour. A contract is being entered into with the Lancashire Electric Power Co. for supplying energy in bulk; the Manchester Corporation also tendered for this supply. The sanction of the L.G.B. is to be obtained to the borrowing of £12,000 for the installation of rotary converters, transformers and switchgear required at the Frederick Road station in connection with the taking of the above bulk supply.

Scarborough.—The Corporation has appointed a Sub Committee to consider the question of the taking over of the Scarborough electric supply undertaking. The Corporation has the option of doing so, if it thinks such a step desirable, at stated

ntervals. The Sub-Committee has been instructed to report generally upon the question of purchasing the undertaking.

Shipley (Yorks.).—The Shipley District Council contemplates extending its scheme of electric street lighting, and has issued instructions for the preparation of a scheme and estimates of the cost of lighting both by electricity and by gas.

Staveley.—Several influential residents are interesting themselves in a scheme for obtaining a supply of electricity for the parish. Energy could be supplied from the Devonshire works of the Staveley Coal and Iron Co., Ltd., and it is understood that efforts will be made to secure a supply.

Sunderland.—The estimates for the Corporation Electricity Department for the year ending March 31st show an income of £67,942 and an expenditure of £61,218, leaving an estimated credit balance of £6,724—a substantial increase on the figures of last year. Of the net profit, it is intended to take £1,200 for the renewal of mains, and place the remainder to the credit of the renewals fund.

Sutton (Surrey).—The South Metropolitan Electric Tramways and Lighting Co. has decided to supply current to consumers at Sutton for heating at 1½d. per KW.-hour on a minimum quarterly consumption of 100 KW.-hours.

Wednesbury.—The Electricity Committee has recommended that application be made to the L.G.B. for sanction to borrow £2,000, for sundry electric mains, and a further sum of £1,000 to cover estimated expenditure on service connections.

Westhoughton.—It was announced recently that the D.C. had decided to approach the Lancashire Electric Power Co. as to whether it would be prepared to discuss terms for an extension of the lighting of the district by electricity.

Whitstable-on-Sea.—The electric light question, referred to in the last issue of the ELECTRICAL REVIEW, was again discussed by the U.D.C. on January 28th, when Mr. A. A. Kemp proposed that the resolution of September 1st, relative to the application of the Council to the B. of T. for a prov. order, be rescinded. On this being carried by 6 votes to 5, Mr. Kemp moved that the Council consider the establishment of an electric light undertaking by a private promoter, and this was adopted by 6 votes to 4.

Wood Green.—As recently stated in these columns, the U.D.C. has decided to sell its provisional order to the Tottenham and Edmonton Gas Co. for £500, subject to terms of supply, repurchase, &c. The Gas Co. is, therefore, seeking the necessary Parliamentary powers to supply electric light. On the other hand, the North Metropolitan Electrical Power Distribution Co. is applying to the B. of T. for an order empowering it to supply Wood Green. At a meeting on January 30th, arranged by the local Chamber of Commerce, the Chamber adopted the unusual course of inviting the heads of both the Electricity and Gas Co.'s to attend, and in response, Mr. Broadberry (manager of the Gas Co.), Mr. Devonshire (chairman of the Electricity Co.), and Mr. Ruthven Murray (the Electricity Co.'s expert), together with Mr. Spencer Hawes (the District Council's expert adviser), were present. Each was invited to express his views, after which they withdrew, and the traders—who will be the principal consumers, apart from the public lighting—voted upon the Council's action.

Mr. Broadberry, for the Gas Co., said his company was binding itself to a maximum price of 5d. per KW.-hour, and undertaking to supply within one year. The Order which the Power Co. was to obtain now fixed the maximum price at 8d., and did not undertake a supply for two years. His company would install gas engines of a new type, which would be almost as silent as sewing machines. It was not securing the Order to stifle it. With both gas and electricity in the hands of one concern, there would be no overlapping of canvassing, and it mattered not to the Gas Co. whether its gas was being used with incandescent mantles, or for the purpose of creating electricity.

Mr. Devonshire, for the Electric Power Co., said the Wood Green ratepayers owed the Power Co. a debt of gratitude, for in 1904 it saved them from what at one time appeared to be a very foolish expenditure, when about to embark upon the huge outlay of £45,000 upon electric lighting. Happily the scheme was abandoned, and he estimated that the Power Co. thus saved the ratepayers an annual expenditure of £12,000. From that time onwards, the Power Co. submitted various schemes for the supply of electricity in bulk, realising that with its enormous plant it could generate far more cheaply than the Council could ever hope to do it. In one bulk supply scheme that came near to adoption, the Council wanted an indemnity clause, to which the company could certainly not agree, so that the scheme was dropped. In 1907 another scheme was presented but never proceeded with. The Power Co. had endeavoured to do business with the Council, but it seemed as if it would not meet with success, and now it had had enough of it. Although the methods of procedure adopted by the respective companies to get the powers were different, they would both meet in Parliament, and he trusted that the Power Co. would be able to convince that high tribunal which was the better of the two schemes.

Mr. Ruthven Murray, the Power Co.'s expert, derided little gas stations, and said they were being scrapped. The maximum of 8d. was merely protective, and was seldom, if ever, reached.

Mr. Spencer Hawes, the Council's expert, emphatically declared himself in favour of the Gas Co.'s scheme, and assured the Chamber of Commerce that the Council had acted in the best interests of ratepayers and possible consumers in agreeing to dispose of its order to the Gas Co., which had treated it most fairly in the matter.

Mr. F. G. Holmes, the only member of the Council against the scheme, said the Council would be at the mercy of the Gas Co. if the scheme were sanctioned by Parliament. He estimated that the total turnover on gas at Wood Green was £50,000 a year, yet the Council was giving the company a monopoly for £500. He believed in competition.

A resolution was carried that the Council's action in agreeing to sell the order to the Gas Co. was not in the best interests of the district. This decision is regarded in the neighbourhood as an important weapon with which to strengthen the hands of the electric light company.

York.—A report shows that the total income of the York electricity undertaking for the nine months ended December 31st, 1912, was £19,901, as compared with £15,944 during the corresponding period of 1911, an increase of £3,956. The expenses were £9,610, having grown from £6,904. The cost per unit during the period was ·53d., as compared with ·80d. The increased demands and the expected requirements of the next winter have resulted in the Electricity Committee recommending the Corporation to apply for power to borrow £30,600 for the purposes of extensions of plant and mains.

The loan is to be applied for, for the following purposes:—3,500-KW. turbo-alternator with condenser, £14,257; two water-tube boilers, with superheater and chain-grate stokers and steam pipes, £4,170; H.T. cables, £6,551; battery room and battery, £4,722; sheds for locomotive and main stores, £600; contingencies, £300.

A poll of the ratepayers was taken on Friday last to determine the future of the proposal to obtain Parliamentary powers to purchase the Gas Co.'s undertaking. Curiously enough, the proposal appears to have been largely supported by the members of the local Electricity Committee, but nevertheless the ballot resulted in a majority of 2,067, out of 8,629, against the proposed Bill.

TRAMWAY and RAILWAY NOTES.

Belfast.—The extension of the tramways system was opened on the 28th ult., and since then there has been a substantial traffic on the new roads—Bloomfield, Donegal Road, Oldpark Road, Ligoneil, Stranmillis Road and Ravenhill Road. The B. of T. inspection was carried out the day before.

Blackpool.—The T.C. has approved of the Tramways Committee's proposal to borrow £10,000 for extensions, including the purchase of six additional "toast-rack" cars.

Brighton.—The T.C. has rejected a proposal of Messrs. Tilling to run a service of petrol-electric 'buses.

Cannock.—The R.D.C. has decided to support the application of the Great Wyrley P.C. to the Walsall Corporation for motor-'bus or tramway facilities between Great Wyrley and Walsall. The P.C. has received a communication from the Corporation stating that the matter will receive consideration by the Tramways Committee, but that the latter could not embark upon any scheme which would not provide 8d. per mile for every car-mile run.

Continental Notes.—AUSTRIA.—An extensive scheme for the enlargement of the tramway network is projected at Trieste, by which some 27 public thoroughfares will be intersected and served by tramway lines. The official authorisation for the preliminary studies has been granted. At Prague the Advisory Committee of the Tramways Co. has recommended the construction of six new lines in that city and its suburbs.—*Elektrotechnik und Maschinenbau.*

Edinburgh.—On condition that the Corporation aids substantially the proposed Zoological Gardens for Edinburgh, and that the gardens will be opened within the next 12 months, the Tramways Co. is prepared to contribute £1,000 to the undertaking.

Glasgow.—At its last meeting the T.C. instructed the Tramways Committee to proceed with negotiations with the various local authorities and other parties interested along the line of route, in connection with a considerable extension of the line of tramways, which, if carried out in its entirety, will add about 20 miles of double track to the system. It is expected that the negotiations will take up the better part of the spring and summer, and upon their success or otherwise will depend the future action of the T.C. in seeking for Parliamentary sanction for the extensions. In submitting the proposals, Bailie Kirkland, the convener, spoke at some length of the great congestion of traffic in the centre of the city. He admitted that the tramways were to a very considerable degree responsible for this, and suggested that in the near future the question of a central relief route would have to be considered. This would probably involve the construction of another bridge over the River Clyde, but if the Corporation approved of the erection of such a bridge as would suit the needs of the tramways department, the latter might be looked to for a large contribution, if not the payment of the whole cost. As to

the extensions, which are, with three slight exceptions, all into the country, and link up villages and populous centres, it was contended that such routes had paid as well as, if not better than, the crowded city lines.

With the extension of the half-penny stage distance on the T.C. tramway cars the fear at first was expressed that there would be a considerable falling-off in the revenue derived. This fear has now had the edge taken off it by the report from the department that the income for the present financial year has exceeded that of 1911-12 (up to the end of February), by over £1,000. The figures are from June 1st to February 1st, 1912-13—£666,617, and June 1st to February 1st, 1911-12, £665,612. While, through 1912 being Leap Year, the last 12 months had one more working day than the present year (and a day's drawings, which will not be included in 1912-13, are averaged at £2,400), it is confidently expected that the record in the income created last year will be eclipsed on the present occasion. So far as passengers carried are concerned, the totals already far exceed those of any previous similar period of nine months, and are nearly 26 millions more than in the corresponding spell of 1911-12.

Goldthorpe.—The U.D.C. has under consideration a scheme for the establishment of a service of railless cars between Bolton, Goldthorpe and Barnsley.

Hertford.—The County Council has decided to abandon the Watford-Bushey tramway scheme, which has been on the boards for 12 years. The introduction of the motor-'bus is considered to account for the decision.

Hythe (Kent).—The T.C. at a special meeting on Saturday decided to support the Bill of the Tramway Co., which is being promoted by Mr. Cownie.

Japan.—The Aichi electric railway is about to commence the construction of a light electric railway about eight miles in length.

London.—Central London Railway.—The work of reconstructing the permanent way has been commenced. This is being carried out at night, three 42-ft. sections being hauled from the depôt where they are built, to the desired position on a special train consisting of bogie trucks, which are motor-driven from Edison batteries. Two of the latter, each with 220 cells, are installed on each truck, and the latter are also provided with cranes for lowering the track into position.

Newcastle-on-Tyne.—The estimates for the ensuing year of the Corporation tramways have been presented to the committee. The income is put at £10,000 more than in the past year, but the estimated expenditure is put a like amount higher, the increased expenses being attributed to higher wages of drivers, conductors, &c., £3,000; street repairs, £2,000; and increased cost of coal, &c. It was reported that several works were urgently needed, including the renewal of lines in Shields Road, Jesmond Road, and Grainger Street, &c., the total cost of which was put at £61,000, which would be met out of the reserve fund.

Northampton. — The Tramways Committee has had under consideration the advisability of adopting a motor-omnibus service or extending the tramways to Far Cotton. It has been decided to take the latter course and construct a double track throughout, with the exception of a portion which will cross the L. & N.W. Railway, at an estimated cost of £17,340. Tenders are to be obtained for carrying out this work, and also for the doubling of certain track, estimated to cost £5,090. With regard to the motor-'buses, the Committee expressed the opinion that 'buses cannot, either as regards reliability or comfort, compete with modern tramcars, and their working expenses were greater than would justify the Town Council in adopting this method of traction.

Salford.—In default of the proposals of the Salford Corporation being accepted as to the terms for the future supply of energy by Eccles to Salford for working the tramways in Eccles by the Salford Corporation, application is to be made to the B. of T. to appoint an arbitrator to settle the question.

Sandgate (Kent).—The U.D.C. has decided to proceed with the petition against the Bill of the Tramway Co. for power to construct and operate a railless traction system in the district.

Scarborough.—The Scarborough South Cliff Tramway Co. proposes to introduce pumping by electricity.

S.E. & C. Railway Electrification.—Speaking at the meeting of the South-Eastern and Chatham Railway recently, Mr. Cosmo Bonsor, who presided, stated that the directors had not abandoned the idea of electrifying the railway. At the present moment, they were having a report made by an eminent engineer as to the wisdom of the proposal. The system, the chairman added, was a difficult one to deal with, for they must either electrify it throughout or leave it alone altogether. The question was entirely one of money.

Sunderland.—The estimates for the year ending March 31st next show an income of £68,769, a slight decrease on the figures for the preceding year. The net profit is put down at £11,076, and of this £6,076 is to be placed to the reserve fund, and £5,000 to the borough fund for the relief of the rates. The slight decrease in income is attributed to the bad weather, which caused a reduction in the traffic to the seaside.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The Federal Government has accepted tenders for the installation of automatic telephone exchanges on the Strowger system in the Glebe, Newtown and Balmain suburban areas of Melbourne. The contract price is about £37,000. The system has already been installed at Geelong, at a cost of £14,293.—*Sydney Morning Herald.*

The report of the Postmaster-General for 1911 shows that the revenue of the Commonwealth from the telephone service increased by £233,674, and from the telegraphs by £40,673. The total length of wire in use for telegraphic purposes was 97,053 miles; the number of telephone instruments in use was 102,654, an increase of 16·5 per cent. The number of telephone exchanges rose from 678 to 927. The telephone trunk lines aggregated 39,088 miles.

Imperial Wireless System.—On Wednesday last week the cross-examination of Mr. W. R. Lawson by Mr. Falconer before the Select Committee occupied the whole sitting. Mr. Lawson admitted that at the time when the contract was drawn up there was no company in the same position as the Marconi Co. to carry out the work. He had said that the effect of wireless telegraphy in naval warfare had not been thoroughly tested or thought out, and that there was no mention of the subject having ever come before the Cabinet, but he withdrew the latter statement. He admitted that the rates to be charged by the Post Office for messages would not be affected by the amount at which the Marconi companies were capitalised, and that if the market value of the shares was excessive, that was not the fault of the company. Regarding his statement that the State had associated itself with a huge Stock Exchange gamble, he said he had never been able to verify the rumours that Ministers had been interested in the speculation.

On the following day, Mr. Lawson withdrew the allegations that wireless telegraphy had never been considered from the point of view of its effects on naval warfare, and that the Post Office had shut itself out from the services of all other patentees. He admitted that the cable companies had been granted landing rights without payment, while the Marconi Co. had been refused a licence in 1910, and that there was no analogy between the position of the cable companies and that of the Marconi Co., and he therefore withdrew his statement that the treatment of the former was in striking contrast to the favour accorded to the Marconi Co. He agreed also that there was no analogy between the positions of the National Telephone Co. and the Marconi Co. He further withdrew his statement that the affiliated companies of the Marconi Co. were all heavily loaded, and modified other passages in his previous evidence.

On Monday Mr. Lawson's cross-examination was continued. The witness protested against the mode of cross-examination adopted by Mr. Falconer, and expressed a wish to take out the whole of his evidence with regard to the Government being tied to the Marconi Co. by the agreement. He agreed that the company was financially in a position to carry out the contract, had a system capable of trans-Atlantic communication, and had a large and highly-qualified engineering staff, a more important consideration than that of patents. The company had great financial influence, but he admitted that the Government were absolutely independent of the company.

A letter was read from Mr. Marconi, stating that he was compelled to go to the United States before March 1st in connection with certain patent actions brought by his company, and must absent himself from London for 10 or 14 days before sailing. He therefore requested to be heard by the Committee as soon as possible. The chairman said they could not break off the journalists' evidence at present; and as the House of Commons would rise on February 14th, the Committee could not call Mr. Marconi till after Easter.

The Committee sat again on Wednesday.

The Committee appointed by the Postmaster-General to advise on the existing systems of wireless telegraphy requests any person desiring to be heard by the Committee to apply to the Secretary, Mr. E. H. Rayner, National Physical Laboratory, Teddington, Middlesex.

The Select Committee, to which the Postmaster-General referred the request of the Marconi Company to be released from the contract, has replied that it cannot advise on the matter until the inquiry is concluded. Mr. Samuel therefore has refused to release the company, pointing out that a provision was embodied in the contract that it should not take effect until approved by the House of Commons.

Telephonic Control of Trains.—The Rhymney Railway Co. have put into operation over their system, which extends from Cardiff into the eastern and western valleys of Glamorganshire, a new train control system making use of the telephone, the first of its kind that has been installed in Great Britain. It was provided by the Western Electric Co., of North Woolwich. By means of a system of telephones to all signal-cabins, junctions, and stations on the line, the whole of the train working can be completely and directly controlled from the head office at Cardiff. It is believed that as the result of the new installation much time will be saved.—*Standard.*

Wireless in the Antarctic.—Several messages have been received from Dr. Mawson, leader of the Australian Antarctic Expedition, who is now in Adelie Land, but, so far, the Australian station has not been able to make him hear any reply.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—February 10th. One 3,000-KW. turbo-alternator, with surface condenser and air pump, for the Corporation. See "Official Notices" January 24th.

Arbroath.—Tenders are invited for the electric lighting work for the reconstructed Sheriff Court House. Mr. P. C. Smith, burgh engineer.

Ashton-under-Lyne.—February 19th. H.T. switchgear, water-softening plant, steam, exhaust and feed pipes, tanks, &c., for the Corporation. See "Official Notices" January 31st.

Australia.—VICTORIA.—February 21st. Four 1,500-KW. rotary converters, for the Melbourne City Council. See "Official Notices" December 6th.

WESTERN AUSTRALIA.—February 19th. Armoured telegraph cable, for the P.M.G.'s department. See "Official Notices" January 10th.

February 27th.—Buildings and boiler-house equipment, turbo-alternators and rotary converters, for a Government power station at Perth. See "Official Notices" January 24th.

SYDNEY.—March 17th. Motors for the City Corporation.

SOUTH AUSTRALIA.—March 5th. One section of a common-battery switchboard, for the P.M.G.'s Department. See "Official Notices" January 31st.

Austria.—VILLACH.—March 1st. Tenders are invited for the supply of three portable 1·3-H.P. rotary current motors, a 10-H.P. rotary current motor, and a 7-H.P. rotary current motor; also for a large number of machine tools for the railway workshops. Forms of tender (2d.) and conditions of delivery (1s.), and other particulars, may be obtained of Abteilung IV, k.k. Staatsbahn-Direktion Villach, Austria.

KRAKAU.—February 19th. Tenders are wanted for the supply of three electric hand-boring machines, three ditto air, the equipment for a 60-ton wagon hoist, a 20-ton electrically-driven movable crane, a movable electric boring machine, a ditto screw-cutting lathe, two electric Universal hand-boring tools, an electric polishing machine, an electric quick-borer and a rotary transformer. Particulars and tender forms from Abteilung IV, Staatsbahn-Direktion, Krakau, Austria.

INNSBRUCK.—February 21st. Tenders are required for the supply of a shaping machine with electrical equipment, an electrically-driven table boring machine for holes 15 mm. diameter, an electric hand-boring machine, the electric equipment of a 40-ton wagon hoist, an electrically-driven hammering machine, and other tools for the railway workshops. Particulars and forms of tender (enclosing 2d.) of Abteilung IV, k.k. Staatsbahn Direktion Innsbruck, Austria.

Beckenham.—February 10th. Arc lamp carbons (flame) and electrical house cut-outs and service boxes, for the U.D.C. The Offices, Beckenham.

Belfast.—February 24th. Stores and materials for one or three years, for the City electricity department. See "Official Notices" January 31st.

Belgium.—February 17th. The Belgian Department of Bridges and Roads in Brussels (52, Boulevard du Regent) are inviting tenders for the necessary installation for the supply of electricity for lighting purposes at the Royal Palace at Laeken.

Birkenhead.—February 11th. Continuous-current electricity meters and house service fuse boxes, for the Corporation. See "Official Notices" January 24th.

Blackburn.—February 15th. Materials for a year, for the Corporation Electricity Department. See "Official Notices" January 31st.

Bolton.—February 13th. Turbo-alternators with condensing plant, water-tube boilers, economisers, switchgear and steam feed pumps, for the Corporation. See "Official Notices" January 24th.

February 24th. Materials and stores, for the Corporation Tramways Department. See "Official Notices" to-day.

Bridlington.—February 8th. One 600-KW. turbo-generator, with switchboard and pipework extensions, for the Corporation. See "Official Notices" January 24th.

Bristol.—February 14th. Arc lamp carbons, joint, junction and fuse boxes, A.C. wattmeters, and D.C. mercury type ampere-hour meters, for the City Electricity Department. See "Official Notices" January 31st.

Cardiff.—February 14th. One steel chimney, with mechanical draught plant, for the Corporation. See "Official Notices" January 31st.

Cheltenham.—February 12th. Electric wiring, Montpellier Baths, for the T.C. Borough Engineer, Municipal Offices.

China.—February 10th. Six 625-K.V.A. three-phase oil-cooled transformers, for the Shanghai Municipal Council. See "Official Notices" January 24th.

Colchester.—February 10th. Duplicate motor-driven air-compressor plant, with pipework, cables, switchgear, &c., for the Committee of Visitors, Essex and Colchester Asylums. See "Official Notices" January 24th.

February 15th.—Rubber and fibre insulating materials, cables, electrical fittings (lighting), electrical equipment (cars), overhead equipment, car fittings, &c., for the Corporation tramways department. Mr. R. C. Bullough, General Manager and Engineer.

Darlington.—February 17th. One 1,000-KW. steam turbo-alternator, one 750-KW. and one 250-KW. rotary converter, and one water-tube boiler, for the Corporation. See "Official Notices" January 31st.

Derby.—February 19th. One 2,000-KW. turbo-alternator, for the Corporation. See "Official Notices" to-day.

Dublin.—February 13th. Water-tube boilers, economisers, pumps, conveying plant, pipework, &c., also boiler seatings and flue work, for the Corporation Electricity Supply Committee. See "Official Notices" January 24th.

February 13th. Arc lamp carbons, for the Corporation. See "Official Notices" to-day.

Edmonton.—February 26th. Electric lamps for the B. of G. Mr. F. Shelton, clerk, The Grange, White Hart Lane, Tottenham.

Egypt.—March 31st. Section des Municipalités invites tenders for electric light installation at Damietta. For further particulars see this column for January 24th.

Finchley.—February 17th. One 300B.-H.P. oil engine, coupled to a 200-KW. E.C.C. generator, for the U.D.C. See "Official Notices" to-day.

France.—PARIS.—February 14th. Tenders are invited by the Administration des Chemins de Fer de l'Etat for the supply of 500 electric connections for bearer rails, 60 metres of naked copper cable of section 200 square millimetres, and 700 metres of naked copper cable of 400 square millimetres section. Particulars may be obtained from Bureaux du Service-Electrique (1st division), 43, Rue de Rome, Paris.

NANTES.—Orders are about to be placed by the Chamber of Commerce of Nantes for three electric cranes. Particulars of the Chamber.

Glasgow.—It is recommended by the T.C.'s Committee on Electricity that it is advisable to proceed with the erection of a new generating station on ground recently acquired for the purpose in Dalmarnock Road, and the engineer (Mr. W. W. Lackie) has been authorised meantime to prepare forms of tender of specification for the erection of one pumping station for the purpose of pumping water from the River Clyde for condensing purposes, at an estimated cost of £3,000.

Grimsby.—February 11th. One 1,000-KW. mixed-pressure turbine and continuous-current dynamo, with condensing plant, for the Corporation. See "Official Notices" January 24th.

Halifax.—February 17th. Stores and materials for a year, for the Corporation electricity department. See "Official Notices" January 31st.

February 17th.—Stores and materials for tramways department for 12 months. Tramways Engineer, Tramways Office, Skircoat Road.

Hornsey.—February 24th. Electricity meters, cables and cable stores, for the T.C. See "Official Notices" to-day.

Ilford.—February 25th. Stores for a year, for the U.D.C. electricity department. See "Official Notices" to-day.

India.—February 18th. High and low-tension switchboards, for the Bombay, Baroda and Central India Railway. See "Official Notices" January 31st.

Leeds.—February 19th. Coal and general stores for a year, for the Corporation electric lighting department. See "Official Notices" January 24th.

February 17th.—The City Tramways Committee invites tenders for electrical sundries and engineers' furnishings and other goods for the tramways during the 12 months ended March 31st, 1914, and also for the reconstruction of certain portions of tramway track, in respect of which tenders may be for six, nine or 12 months. General Manager, Tramway Offices, City Square, Leeds.

London.—BERMONDSEY.—February 17th. Stores for a year, for the B.C. Electricity Department. See "Official Notices" January 24th.

L.C.C.—February 11th. The tramways department is inviting tenders for 584 tons of special section mild steel bars for magnetic brake shoes. Specifications and form from Mr. A. L. C. Fell, Chief Officer of Tramways, 62, Finsbury Pavement, E.C.

L.C.C.—February 25th. Electric wiring of the Camberwell and Cressy Road car-sheds. See "Official Notices" January 31st.

FULHAM.—February 19th. Electrical and engineering stores for a year, for the B.C. See "Official Notices" to-day.

ST. PANCRAS.—March 4th. Arc lamp carbons, for the B.C. See "Official Notices" to-day.

SHOREDITCH.—The B.C. Lighting Committee is to invite tenders for economisers for Whiston Street generating station.

MARYLEBONE.—February 26th. Stores and materials for a year, for the B.C. Electricity Department. See "Official Notices" to-day.

MARYLEBONE.—February 12th. Converting plant, for the B.C. See "Official Notices" to-day.

Manchester.—February 18th. General stores for a year, for the Corporation tramways department. See "Official Notices" January 31st.

Morocco.—March 27th. 15,000 insulators for the Post and Telegraph service. Tenders to M. le Président de la Commission Générale des Adjudications et des Marchés, Dar-En-Niaba, Tangier. Deposit, 1,000 fr.—*Board of Trade Journal.*

Newcastle-on-Tyne.—Messrs. C. A. Parsons & Co., Ltd., Heaton Works, are inviting tenders for a 10-ton single-motor electrically-driven travelling jib crane, 4 ft. 3½ in. gauge, with travelling, lifting and slewing motions, about 16 ft. radius, fitted with overhead trolley collectors, all for 110 volts D.C. supply.

Oldham.—February 21st. Two 500-KW. motor-alternators, for the Corporation. See "Official Notices" to-day.

Portsmouth.—February 10th. Arc lamp carbons (Conradtys), for the Corporation Electricity Department, for a year Electric Light Station, Gunwharf Road.

Prague.—February 28th. Tenders are invited for the supply of machine tools, with electric equipment, to the Bohemian Northern Railway. Particulars (enclosing 2d.) from the Direktion der Böhmische Nordbahn, Abteilung IV, Prague.

Rochdale.—Engine room extension, new boiler house, &c., turbo-alternator, condensing plant, motor-alternator, water-tube boilers and boiler house equipment for the Corporation. See "Official Notices" to-day.

Sheffield.—February 8th. The Corporation Tramways Committee is inviting tenders for 1,000 tons of steel tramway rails. Specifications, &c., £2 2s. (returnable), from Mr. W. J. Hadfield, Surveyor of Highways, Town Hall.

South Shields.—February 17th. Uniforms, for the Corporation tramways department. See "Official Notices" January 31st.

Uruguay.—March 29th. Five electric gantry cranes for Customs warehouses at Monte Video. B. of T. C.I. Department in London

Walthamstow.—February 28th. Four double-deck tramcars complete with magnetic-brake equipments, for the U.D.C. See "Official Notices" to-day.

CLOSED.

Admiralty.—The Walsall Electrical Co., Ltd., has received an order from the Admiralty for 1,000 switches and sockets.

Australia.—The *Australian Mining Standard* states:—"With reference to the acceptance of the tender of Australasian Wireless, Ltd, Sydney, for the installation of wireless telegraph stations at Sydney and Fremantle, it is notified that the price covered by such acceptance has been increased to £6,150 in the case of the station at Sydney."

One lamp signalling trunk-line switchboard of nine sections, one three-position recording desk and one chief operator's desk, for £2,079, has been ordered by the P.M.G., Melbourne, from the Western Electric Co. (Aust.), Ltd., Sydney.

The same contemporary states that Messrs. W. G. Watson & Co., Sydney, have received an order for 11,000 Hellesen dry cells, which completes a total of 33,000 supplied for the Sydney Post Office.

The Prahran-Malvern (V.) Tramways Trust has accepted the tender of Messrs. Siemens Bros., Melbourne, for an automatic reversing booster and switchgear, at £971.

Bradford.—The Board of Guardians has accepted the offer of Messrs. C. A. Parsons & Co. of a new commutator for one of the turbo-generators of the workhouse plant, at a cost of £75.

Cheltenham.—The Borough Education Committee has accepted the tender of Messrs. R. E. & C. Marshall for the electric light installation at Haunton Park Centre, at £31; and that of Mr. F. H. Bastin for the electric light installation at Marlborough House, at £26.

Dover.—The tender of Messrs. J. Wright & Sons, at £42, has been accepted by the T.C., for wiring the St. Martin's Schools.

Eastbourne.—The T.C. has accepted the tender of the British Westinghouse Electric and Manufacturing Co., for a 1,500-KW. turbo-alternator, without condensing plant, running at 3,000 R.P.M. for £5,236. The turbine is to be of the pure impulse type. Fifteen other tenders were received.

Eccles.—The tender of Messrs. Joseph Chapman & Sons, Patricroft, is to be accepted for the erection of the extension to the boiler house at the electricity works, for £518.

The T.C. has accepted the tender of Messrs. J. and G. Weir, Ltd., at £80, for the provision of an additional feed pump at the electricity works, and that of the British Electric Transformer Co., Ltd., at £115, for the installation of a 150-K.V.A. transformer.

Glasgow.—The Electricity Committee has recommended the acceptance of (1) an offer by Messrs. Willans and Robinson, Ltd., for one set of Curtis-Parsons turbo-alternators and condensing plant, at £16,064; and (2) an offer by the British Westinghouse Electric and Manufacturing Co., Ltd., for one set of Curtis-Rateau turbo-alternators and condensing plant, at £16,721.

Gloucester.—The Electricity Supply Committee has accepted the tender of the Phœnix Dynamo Manufacturing Co., Ltd., for two new armatures for No. 6 generating set, at £580, and that of Messrs. Sisson & Co., at £35, for alterations to the governors, &c. The engine will be able to run at full load at reduced speed after these alterations.

Haslingden.—Mr. A. M. Cramp, of Haslingden, has secured the contract for electric lighting, power, bells, telephones and vacuum suction plant for Springfield Lodge, Haslingden, the new residence of Councillor R. Waddington, chairman of the Electricity Committee. Mr. Cramp is also carrying out the electrical equipment of Messrs. S. S. Stott & Co.'s Laneside Foundry and Elevator Works, Haslingden.

Ilford.—The U.D.C. has accepted the tender of Messrs. W. T. Henley's Telegraph Works, Ltd., at £87 10s., for the supply and delivery of 100 yd. of cable for switchboard connections.

Ipswich.—The B.G. has accepted the tender of the Chloride Electrical Storage Co., Ltd., for the maintenance of the storage battery at the Workhouse for five years.

Leyton.—The U.D.C. has accepted the tender of the Paterson Engineering Co., Ltd., at £150, for installing a cold process water softener at the electricity works.

Liverpool.—The following tenders have been accepted by the T.C.:—

Jas. McKelvie & Co.—Annual supply of about 1,500 tons best Arley gas slack to the electricity department.
Halley's Industrial Motors, Ltd.—Chassis for motor tower wagon.
Sutton Heath and Lea Green Collieries, Ltd.—Annual supply of steam slack to the Lister Drive power station.

The following have also been accepted for plant for the Lister Drive power station:—

Babcock & Wilcox, Ltd.—Six boilers with chain grate stokers, stoker gear and steel up-take flues; induced draught fan, complete with motor; gravity bucket coal conveyor and motor; overhead coal bunkers and floor for supporting economisers, flues and fans.
E. Green & Son, Ltd.—Six economisers.
Jos. Crawford.—Four induced draught fans and control panels, motors and platform.

London.—SHOREDITCH.—The B.C. Lighting Committee has contracted with Messrs. Harrison, Tidswell & Co. for up to 2,000 tons of Whitwick deep seam slack, at 14s. 5d. per ton, delivered free alongside Whiston Street power station.

STEPNEY.—The B.C. Electricity Committee has accepted the offer of Messrs. W. Geipel & Co. for 28,000 Henrion flame arc lamp carbons, at 14s. 6d. per 100, less 50 per cent. discount. It also recommends the acceptance of the tender of Messrs. Strachan and Henshaw, Ltd., Bristol, for the extension of the telpher track at Limehouse station, for £2,722. Messrs. E. Wood & Co., Ltd., Manchester, tendered at £2,752.

POPLAR.—The tender of Messrs. M. Keenan & Co. has been accepted by the B.C. at £91, for lagging the main steam, feed, and blow-down piping in the extension at the generating station.

Manchester.—Messrs. Higginbottom & Mannock have received an order for the supply of six 2-ton electric cranes for No. 9 dock.

Mersey.—The Mersey Docks and Harbour Board has accepted the tender of Messrs. Geo. Russell & Co., Ltd., for 30-cwt. movable electric roof cranes for the double-storey shed on the south side of the Brocklebank Branch Dock.

Morecambe.—The Corporation has approved the acceptance by the Tramways Committee of the tender of Messrs. Hill and Smith, Wolverhampton, for the supply of an unclimbable iron fence at Bare in connection with the new tramway sheds.

Newport.—February 22nd. General stores for a year, for the Corporation electricity and tramways department. See "Official Notices" to-day.

Salford.—The T.C. has accepted the tender of the A.E.G. Electric Co., for the supply of 500 electric lamps at 30s. per doz., less 27½ per cent., also the tender of W. T. Henley's Telegraph Works, Ltd., for an annual supply of wire to the tramways department. Two overload circuit breakers are to be purchased from Mr. Bertram Thomas, for £90. The tender of Messrs. Mather and Platt, Ltd., has also been accepted, at £635, for the supply and delivery of filtration plant at the electricity works.

Walthamstow.—February 28th. Annual stores for the electricity and tramway departments. See "Official Notices" to-day.

Willenhall.—The U.D.C. has accepted the tender of the Rees Roturbo Manufacturing Co. for the pumping plant in connection with the new sewage disposal works.

FORTHCOMING EVENTS.

Association of Mining Electrical Engineers.—Friday, February 7th. At 8 p.m. At the I.E.E., Embankment, W.C. Paper on "Cables for the Shafts of Mines," by Mr. E. K. Scott.

(West of Scotland Branch).—Saturday, February 15th. At 4.30 p.m. Meeting at the Royal Technical College, Glasgow.

Royal Institution.—Saturday, February 8th.—At 3 p.m. Lecture on "The Properties and Constitution of the Atom," by Prof. Sir J. J. Thomson. (Lecture I.) Saturday, February 15th.—(Lecture II.)

Association of Engineers-in-Charge.—Saturday, February 8th. At St. Bride's Institute, E.C. Social. Dance.

Wednesday, February 12th.—At 8 p.m. At the St. Bride's Institute, E.C. Paper on "The Control of Alternating-Current Motors," by Mr. J. T. Mould.

Salford Technical and Engineering Association.—Saturday, February 8th. At 7 p.m. At the Royal Technical Institute, Salford. Lecture on "Our Annual Trip Round the Sun," by Mr. C. M. Dorman, M.I.E.E.

Institution of Post Office Engineers (Metropolitan Section).—Monday, February 10th. At 6 p.m. At the I.E.E. Paper on "Loading Coils," by Mr. S. A. Pollock.

Institution of Electrical Engineers (Newcastle Section).—Monday, February 10th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper on "The Special Application of Electricity in Warships," by Mr. A. P. Pyne.

(Manchester Section).—Tuesday, February 11th. At 7.30 p.m. At the University, Manchester. Paper on "Advertising Electricity," by Mr. H. C. Palmer.

(Scottish Section).—Tuesday, February 11th. Meeting at 8 p.m. At Princes Street Station Hotel, Edinburgh.

Saturday, February 15th.—At 7.30 p.m. At the Grosvenor, Glasgow. Annual smoking concert.

(Birmingham Section).—Wednesday, February 12th. At 7.30 p.m. At the University, Birmingham. Paper on "The Parallel Operation of Alternators," by Mr. A. R. Everest.

(Yorkshire Section).—Wednesday, February 12th. Meeting at the University, Leeds. At 7.15 p.m. Lecture on "Some South American Electric Plants," by Mr. T. Harding Churton.

(London).—Thursday, February 13th. At 8 p.m. Paper on "Parallel Operation," by Mr. A. R. Everest.

(Dublin Section).—Thursday, February 15th. Meeting at 8 p.m. At the Royal College of Science, Dublin.

Junior Institution of Engineers.—Thursday, February 13th. At 2.30 p.m. Visit to the works of the Osram Lamp Works, Ltd., Hammersmith.

Friday evening, February 14th.—At 39, Victoria Street, S.W. Paper on "Electrical Installations in Metal Conduit, with Special Reference to Earthing," by Mr. F. H. Taylor.

Saturday, February 15th.—At 6.30 p.m. At the Hotel Cecil. Annual dinner.

Institution of Mechanical Engineers.—Friday, February 14th. At 8 p.m. Annual general meeting. Paper on "Modern Condensing Systems," by Mr. A. E. L. Scanes.

Birmingham and District Electric Club.—Saturday, February 15th. At 6.30 p.m. At the Swan Hotel, Birmingham. Annual dinner.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week :—

Monday, February 10th.—"A" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Tuesday, February 11th.—"B" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Thursday, February 13th.—"C" Company. Company training, 7 to 10 p.m.

Friday, February 14th.—"D" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Saturday, February 15th.—Headquarters will be open from 10 a.m. till 12 noon for regimental business.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adjt.,
For Officer commanding L.E.E.

The Electrical Trades Benevolent Institution and Life Insurance.—We have received from Mr. Hawes, the secretary of the above Institution, particulars that are being issued by the Provident Clerks' and General Mutual Life Assurance Association respecting life and endowment insurance. This office undertakes to afford to members of the Institution an opportunity to effect life insurance on easy terms. Weekly payments can be made through the Institution's properly-appointed representatives. Full information as to scales for whole life, limited premium, and endowment policies can be obtained either from Mr. F. B. O. Hawes at 18, Park Mansions, Vauxhall Park, S.W., or the secretary of the Assurance Association named, at 27 and 29, Moorgate Street, London, E.C. It is hoped that the arrangement will form an inducement to many of the younger men in the industry to become members of the Benevolent Institution (minimum subscription 10s. per annum). Ten per cent. will be added by the Institution to the amount assured when the same becomes payable.

Glasgow International Exhibition.—There is a movement on foot for holding an International Exhibition in Glasgow in 1915 or 1916.

NOTES.

Parliamentary Notes.—UNDERGROUND TRAMWAYS.—Last week Mr. Kellaway asked the representative of the First Commissioner of Works whether, with a view to diminishing the existing congestion of London streets, his department had at any time discussed with the London County Council the possibility of allowing underground tramways to be made under thoroughfares and land within the jurisdiction of the Office of Works in such a manner as not to interfere with the amenities of any street or path beneath whose surface such tramways might be run. Mr. Benn replied that the possibility of allowing subways for tramways under land, &c., in the control of the Department was discussed with the London County Council in 1906. The First Commissioner was prepared to consider any further representations which the Council might make on the subject.

SHEFFIELD CORPORATION BILL.—According to the *Times* Parliamentary report, the House of Lords had under consideration the Commons' reasons for disagreeing with certain of the Lords' amendments. Lord Southwark moved that the House do not insist upon their amendments, but he also moved the insertion of a new sub-clause restricting the right of the Corporation to supply electrical fittings. This, he said, was an agreed compromise, and after a short discussion the motion was agreed to.

The following is the new sub-Clause to Clause 90 in lieu of sub-Clause 2 :—

"The Corporation may enter into contracts for the execution of any of the powers of this section, including the wiring of private property. The Corporation shall not under the powers of this section sell any such electrical fittings (other than electric lines, fuses, switches, ceiling roses, and such other electrical fittings as are used in connection with the wiring of private property from the distribution main as far as the ceiling, wall or floor outlet only), except through a contractor carrying on his business independently of the Corporation."

Lord Southwark said that the new sub-Clause practically meant that the Corporation would now have the power to carry wiring as far as the walls and the ceiling, and that the traders would have the rest of the work in connection with electric lighting.

Inquiries.—A correspondent wishes to get into touch with the makers of self-starting synchronous motors, British or Continental. The name of makers or agents of the "Leanda" lamps is asked for.

Newcastle Contractors' Dinner.—The Newcastle-on-Tyne Branch of the Electrical Contractors' Association held their annual dinner in that city on the 1st inst. The chair was occupied by Mr. W. Fletcher, and there was a fairly numerous company present.

The chairman proposed the toast, "The Electricity Supply Authorities." He said that the relations between the supply authorities and the contractors in that district were of a very friendly character. An evidence of this good feeling was to be found in the recent Electrical Exhibition in Newcastle-on-Tyne, where the contractors and the supply companies worked together with great success, and, he thought, to their mutual benefit.—Mr. C. Turnbull (electrical engineer, North Shields), in replying, referred to the relations between the wiring contractors and the supply companies, and said he thought the trouble was that everybody wanted something cheap. It was a difficult position, and it appeared to him that the chance of getting prices up was remote. It was a young industry, and one in which there was room for more efficiency. In looking over the details of gas companies' undertakings, he was struck with the large percentage of residuals of commercial value that were left over; if they could do something of that sort in regard to electricity, they might get down to 2d. per unit, and the day would not be far distant, as indeed he hoped it was not, when the consumer would be willing to pay a reasonable price for his installation. He thought that the way to do this was by co-operation between the wiring contractors, the supply authorities, the manufacturers and everyone in the trade, in order that they might be able to get cheaper materials—copper and rubber, for instance. Copper was one of the dearest metals in the market, and rubber as a commercial material was extremely expensive. He believed that many of their wires could be made of some cheaper material than copper, and that insulation might be made at a quarter the cost of rubber; but if they were to experiment in this direction, they should have some kind of testing authority which would examine all materials put forward, and would not pass any material to come into general use until they were satisfied that it would be good. By co-operation they could do much for the benefit of everybody. Commenting on the advance they were making in electrical machinery, he mentioned that Messrs. Parsons were constructing a turbine of 25,000 KW., and expressed the hope that in the not very far distant future they would see machines like that in use throughout the district.

Mr. J. Gledson gave the toast, "The Electrical Contractors' Association," the principal object of which was, he took it, the maintenance of a proper status in the profession, and to ensure the recognition of their rights.—Mr. R. Robson (the hon. secretary) responded to the toast, and said that the Association had devoted much of its time to opposing Bills in Parliament, and had been very successful in that respect and in getting clauses altered in favour of their trade. Perhaps, if their energies had been expended in other ways, they might have increased their membership. He thought it was about time that the Association, instead of devoting all its energies to fighting Corporations and municipal trading, devoted some of its time to fair trading. Mr. Cross had done an enormous amount of work in trying to make arrangements with the Manufacturers'

Association for fair trading by allowing the buyer to have a legitimate profit over anybody else for the same quantity of material purchased.

Mr. A. Andrews proposed the toast of "Kindred Electrical Trades." He said the electrical contractors were in that unfortunate position known as middlemen, but he thought that they could ask the Manufacturers' Association to grant them preferential tariffs. One of the originators of the Manufacturers' Association was Mr. Byng, who had written very largely upon preferential tariffs, and he suggested to Mr. Spence, who had to respond to that toast, that he should use his endeavours to get the contractors some preferential tariff as compared with the ordinary trader.—Mr. J. Spence acknowledged the toast, and said the delicate points put forward by Mr. Andrews required careful consideration. With regard to preferential tariffs, the manufacturers, as they knew, were in a most peculiar position. Although rather late in the day, the electrical manufacturers in this country had formed themselves into an Association, not for their own benefit altogether, but also for the benefit of the whole industry. The chief gain was mutual, since it came through standardisation in every department. Questions relating to treatment, tenders, time guarantees, and public bodies could be much better dealt with by an Association. The manufacturers had no desire to injure any other interest, least of all that of the contractors, upon whom they looked as their very best friends. The question of preferential treatment, however, was a very difficult one to discuss. He had been at a number of meetings of manufacturers, and he knew what was going on inside, and he could assure the contractors that this matter was receiving very serious consideration.

During the evening an interesting musical programme was provided.

Annual Socials and Dinners.—Newcastle-on-Tyne.—On Friday evening last at the Central Exchange Hotel, Grey Street, Newcastle-on-Tyne, the staff dinner of Messrs. J. H. Holmes & Co. was held, Mr. Alfred Holmes presiding over a goodly company, which included several engineers engaged in electrical business in the Tyneside district. After the usual loyal toast, Mr. T. W. Wallis, London representative, proposed "The Firm." This was drunk with great enthusiasm, and Mr. A. Holmes, the senior partner in the firm, responded. There was an excellent programme of music and song. In addition to the customary printed programme, there was a second, which was in distinctly humorous vein, and was distributed after the tables had been cleared. It occasioned a good deal of merriment.

Warrington.—The staff of the St. Helens Cable and Rubber Co., Ltd., held their annual whist drive and dance on Friday evening last, from 7.30 p.m. to 2 a.m., at Winmarleigh Café, Warrington. An invitation card of special design was issued in connection with the event.

Dundee.—The manager, Mr. D. Fisher, presiding at the annual supper and dance of the employés of the Dundee and Broughty Ferry Tramway Co., said the company had had a successful year, and they had been throughout loyally supported by the staff. Mr. Wm. McGill, the secretary, congratulated the company and the employés on their immunity from accidents during the year.

Accrington.—Fifty-six Accrington Corporation tramway men, including the Haslingden staff, sat down to dinner, on January 30th, and afterwards adjourned to the Central Conservative Club. Mr. Pilling, the general manager, presided, and was supported by Mr. Kay, the Haslingden general manager, and Mr. Calvert. During the evening, the presentation of a clock was made to Mr. A. Duffy, in recognition of his services in connection with the benevolent fund for men who have been off work through sickness or accident while on duty.

Blackpool.—The employés of Blackpool, St. Anne's and Lytham Tramways Co. held their seventh annual dinner and entertainment, on January 30th. Mr. H. W. Laing, general manager, presided and was supported by Mr. Wood, traffic manager, Mr. Partington, car-shed foreman, and other heads of departments.

London.—The Mazda-Gems held a very successful Bohemian concert at the Talbot Restaurant, London Wall, E.C., on Monday evening. Mr. E. Coote presided with much geniality over a gathering which taxed the holding capacity of the hall to its fullest extent. An excellent programme was provided and was enthusiastically received, number after number being encored. Clever caricatures of the heads of departments on the programme, and the general get-up of the latter, reflect credit on the firm and on the designer. The evening was most successful throughout, and everybody present will eagerly look forward to the next B.T.H. event of the kind.

Copper.—Messrs. Merton's statistical circular for January 31st, 1913, shows a reduction in European visible supplies of 2,161 tons, made up of 2,343 less in English ports and 118 less at Havre, against an increase of 300 tons in the quantity afloat. Rotterdam (not included in the above) shows 400 tons better, and Hamburg 1,621 tons, so, if these were included, the reduction during January would be only 141 tons.

Arrivals from North America are well up to average; from Spain and Portugal, fairly high at 1,983 tons, the average being about 1,750 tons. Shipments from Chile are well up at 4,800 tons, a figure not reached since 1908; the average shipments from this country over the past 12 months are good, and the country appears capable of a steady output. Australian shipments are also strong and well maintained. The total deliveries are 46,057 tons, the highest figure since last June. The stocks in American Producers' hands (American Producers' Association) at the end of December are given as 47,014 tons, an increase of 8,548 tons over the quantity on November 30th. The total visible supply, including Holland, Germany and the United States, for the end of December, 1913, stood at 90,225 tons, an increase of 8,478 tons over the previous return.

The Corthesy Steam Turbine.—We have been able to gather further information concerning this proposal for a turbine without blades, and we find that it consists practically of a rotating annular drum, that is to say, the rotor and the casing are attached and rotate together, and steam is admitted by a nozzle or nozzles into the annular space in the direction of rotation. The drum thus rotates inside a whirl of steam. The length of the drum is divided by ring plates or diaphragms into several divisions of increasing cross-section and passes from one division to the next by a series of nozzles. At present we only seem to see in these division plates a means of imposing on the steam a path of sufficient length. For the rest our sketch of last week stands good. It only remains, therefore, to effect a proper joint at the first end of the turbine and a suitable connection to a condenser, in order to demonstrate what this smooth turbine will do. That it is unexpectedly powerful can be readily believed, and its value will be great if it only succeeds in being nearly as efficient as a bladed turbine. All that remains to be done is, therefore, to prove its efficiency in commercial sizes. Needless to say that though both casing and rotor are moving with the steam, their motion relative to the steam is small, and the action depicted in our figure will take place with so much better efficiency seeing that both surfaces of impact are in motion. The proposal is of extreme interest if it can be proved far enough.

Treatment after Electric Shock.—The Highways Committee reported to the L.C.C. at Tuesday's meeting that they had arranged for lectures and demonstrations to be given to those employés in the tramways department whose work may bring them into contact with electrically-charged apparatus, in order that they may receive instruction in the treatment of persons suffering from electric shock. The number of men affected is about 300, and they will be divided into classes of about 15 each. The total expenditure will amount to about £42.

L.C.C. Turbine Repairs.—The Highways Committee reports that an accident occurred in July, 1912, to the generator coupled to No. 8 turbine at the Greenwich generating station, which necessitated the provision of new windings and other repairs. The work was put in hand at once by the makers of the machine, the British Westinghouse Electric and Manufacturing Co., Ltd. The cost of the work amounted to £2,010.

Post Office Engineers.—The ninth annual dinner of the Engineering Department, London, was held on January 29th, at the Connaught Rooms, Kingsway, W.C., the chair being taken by Mr. William Slingo, Engineer-in-Chief to the Post Office.

After the loyal toasts, in proposing the toast of "The Engineering Department," Mr. Herbert Samuel said there never had been an occasion when the Department was more deserving of toasting; the year 1912 had been a most arduous one for the engineering branch, which had been concerned with vast changes—the inventory of the National Telephone Co.'s plant, and the transfer of that great undertaking to the State; the amalgamation of the two systems, and of the two staffs; the arbitration, the greatest arbitration of its kind that had ever taken place in this country; and the readjustment of their engineering districts. One other event had happened which they might wish to see continued and repeated in future years—the introduction of higher scales of pay for certain of the classes. The efficiency of the telephone business depended to a large degree upon the way in which it was worked by the engineering staff of the Post Office, and he trusted that they would do their best to see that the public got a really efficient and satisfactory service. The development of the service was likely to be rapid. In the present financial year they would spend on construction, renewals, and maintenance, a sum of about 5½ million pounds. The money had been available before, but the staff had had so much to do that they had not been able to spend it. The future development of the telephone service was greatly bound up with the introduction, to a continuously increasing degree, of automatic systems. The experiments that had been made had been very successful, and the Department was taking steps to extend the use of automatic appliances. The late Engineer-in-Chief, Major O'Meara, was still assisting the Department, as special commissioner, and was investigating telephone systems on the Continent. They proposed to make an experiment of a very interesting kind; in some small towns, with less than 50 subscribers, an automatic installation was to be provided which would look after itself entirely. It would merely enable the subscribers to get into touch with the exchange in the nearest large town, and also enable the operators in that exchange to ring up the subscribers in the small place. One other development was the provision of a tube railway for the exclusive use of the Post Office in London. The scheme was well advanced, and the Post Office would before long have a tube of its own for the carriage of its mails and parcels from one end of London to the other. It was a great pleasure to him to toast their new Engineer-in-Chief, Mr. Slingo, who had risen in the Engineering Department from the lowest ranks up to the top.

Mr. W. Slingo, in reply, referred to the wonderful strides which the Engineering Department had made and the very great impression which he was sure the Department had made upon the heads of the Post Office. The importance of the work and the honour and credit of the Department were undoubtedly on the mind of every man on the staff; they were alive to the great interests entrusted to them and to the great work they had to do. The Department was increasing rapidly. Their expenditure this year was twice as much as it was last year, but they had done more than twice as much work for the double expenditure. The staff increased during the year by the acquisition of the National Telephone Co.'s staff from 9,000 to 18,000 men. The staff had under-

gone a reorganisation, and a largely extended benefit had resulted. He did not want a contented staff. A contented staff was a staff without ambition, and could never progress He hoped no one would imagine that because there were to be no examinations there would be no selection. He was prepared to make the selection as keen as ever it was. The inventory had almost been forgotten; he wondered if anyone realised how much work there was in the inventory operations. The valuation, which succeeded the inventory, and to some extent proceeded concurrently with it, was another big work. Only those who went through that mill would ever know the extent of the grinding, and the time would come when credit would have to be given to some of the officers who so zealously threw themselves into this work. It was an honourable fight. They had been more than 74 days in Court, and at the end of that time there was hand-shaking all round, proving that there was the utmost good feeling.

Mr. W. Noble, on rising to propose the toast of "The Visitors," said they had with them not only the *élite* of the Post Office service but also the *élite* of the allied engineering professions outside the service, to whom they gave a very hearty welcome. He first referred to the "officially dead," namely, their veterans. Sir John Gavey would always have a very hearty welcome. It was only a few days since Mr. Kempe left them; recently, when he delivered a very interesting address at their Institution, one gentleman made the shortest speech on record: "Mr. Chairman and gentlemen,—Can you wonder that we all love Kempe?" With regard to their "officially live" guests, it was the universal opinion of all officers of the Post Office that they never had a more able Postmaster-General, nor one who had obtained such a grasp of the work of the great Department over which he presided.

Mr. A. M. J. Ogilvie and Mr. W. Duddell replied to the toast, and Mr. A. W. Martin proposed the toast of "The Chairman," who briefly responded.

Institution and Lecture Notes.—Association of Mining Electrical Engineers.—At a joint meeting of members of the Association and of the Yorkshire Branch of the National Association of Colliery Managers, at Leeds, last week, Mr. David Bowen, acting head of the Mining Department of the Leeds University, gave an illustrated lecture on "An Account of Experiments on Safety Devices in Connection with Electrical Machinery for Coal Mines," with many details of experiments carried out at the University by himself and Mr. Walter C. French. He referred to the experiments carried out in Germany several years ago by Prof. Heise and Dr. Thiem, and continued by Messrs. Beyling and Goetze in Germany, and said that they had since been proved by himself and Mr. French to be unacceptable.

The Iron and Steel Institute.—The annual meeting will be held at the Institution of Mechanical Engineers, Storey's Gate, Westminster, on Thursday and Friday, May 1st and 2nd. The Bessemer Gold Medal will be awarded to Mr. Adolphe Greiner, general director of the Société Cockerill, Seraing, vice-president of the Institute. The annual dinner will be held at the Hotel Cecil on Thursday, May 1st. The autumn meeting will be held at Brussels, at a date to be announced later.

Royal Society of Arts.—On Wednesday evening, a paper on "The Economic and Hygienic Value of Good Illumination" was read by Mr. Leon Gaster.

The Society of Engineers (Inc.).—On February 3rd, a paper on "The Bus *v.* Tram Controversy, and Other Aspects of the London Traffic Problem," was read by Mr. Wm. Yorath Lewis, who endeavoured to awaken Londoners to the seriousness of the present situation, urging that the traffic facilities should be controlled by Government. The formation of a "London Transport Association" was suggested, for the purpose of studying the problems, educating the public, and using all possible means to secure cheap and effectively rapid transport. At present, he said, the London County Council was baulked in every direction, and its tramway undertaking was excluded from the lucrative short-journey traffic which would be ensured by inter-connections through the central area. The author then investigated whether motor-omnibuses adequately filled the needs of the central area and the connections with the immediate surroundings, concluding that if they did so, which was not by any means the case, it was only at enormous cost to the traveller using them, although they operated under conditions of unmatched freedom, conditions which could not be justified. The "door to door" speed possible with 'buses within the central areas was on the average only 4 miles an hour. The average amount paid per passenger-mile ridden was at least 1d., and of every penny taken 58 per cent. was clear profit. In comparison with this, on the Glasgow tramways the amount paid per ridden mile was under a halfpenny, and on the L.C.C. tramways the amount paid per ridden mile was as low as $\frac{3}{8}$d. The huge profit made by 'buses in the central area enabled the omnibus company to make big average profits, even if the suburban traffic was run at such rates as left in some cases little, if any, margin. Mr. Lewis concluded that the Adkins-Lewis system of continuous transport was superior to motor omnibuses and tramways for the central area.

Lamp Standards for Motor-Car Electric Lighting Installations.—At a recent meeting of the Standards Committee of the American Society of Automobile Engineers, in New York, a report was presented by the Division on Lamp Standards. The relative advantages of the earthed and unearthed returns for lighting systems commanded attention on account of the rapid development in car electric lighting recently. It was brought out that the earthed return provided bigger contact points and better insulation of the lamp receptacles. Further, with earthed returns there were fewer connections at the switch; an ordinary system involving head, side and tail lamps had 11 connections with the earthed, as against 14 with the unearthed system.

As to the advantages of the unearthed return, they all hinged on the fact that accidental earthing on the battery side of an earthed return system short-circuited the current and damaged the battery; whereas, in the unearthed return system it would be necessary to earth both sides of the circuit simultaneously. With earthed systems horns and other dash electric devices must be carefully insulated from the metal parts of the body. No definite recommendation was made on this point.

The report recommended that standard electric light bulbs be known as 7-volt bulbs, and have an efficiency of 1·1 watts per candle at voltages between 6·5 and 7 volts. Standard electric headlights are to be $2\frac{1}{16}$ in. in diameter, and capable of being focused in a reflector of 7—8 in. or greater focal length. An effort is being made to get data from battery makers from which to specify standard dimensions of batteries and plates, giving three standard plate sizes from which batteries of any capacity can be made by increasing the overall battery length.

Electricity Supply Rifle League.—On Saturday last the first annual dinner of the League was held at the Talbot Restaurant, London Wall; the president, Sir Alexander Kennedy, occupied the chair, and there was a large gathering of members and guests, numbering over 100.

After the toast of "The King," Mr. L. L. Robinson, electrical engineer and manager to the Hackney Borough Council, proposed success to the League, remarking that the Hackney staff were the prime movers in forming the League early last year, and that they had a most energetic secretary in Mr. E. Matthews. Westminster had won all their matches, and scored 20 points, Central being second with 14. All managers, he said, were anxious to encourage the League, which had proved a splendid thing; they would endeavour to promote shoulder-to-shoulder matches, so as to get acquainted with one another at the different works. Hackney had an excellent range of 100, 50 and 25 yards, and they hoped to hold a gala day there next summer.

Mr. Matthews, who received an ovation, said that in addition to the undertakings already enrolled, those of Brompton, St. James's, Poplar, Bermondsey and Hampstead were coming along this year.

Mr. S. T. Dobson, of the St. James's Co., briefly proposed the health of the President, who, in responding, said he was more concerned with the 13·5-in. gun, having a range of 20,000 yd., than with the rifle. He was pleased to see that the shooting men were drawn from every branch of the staff; that was an ideal condition. He conveyed a challenge to the League from the Railway Rifle League to a match (which was at once accepted), and offered to present a disappearing target apparatus to the League if they would devise one. He then presented souvenir medals to the members of the Westminster team:—Messrs. H. A. Pearman (average 96·2); Foster (95·4); Neville (95·3); Winchcombe (94·86); Partridge (93·9; W. A. Pearman (92·0); Horley (91·8); Litt (90·0); and White (89·87).

Mr. C. Newton Russell, proposing the "Visitors," said that all the sports clubs that had been formed at Shoreditch had proved failures with the exception of the rifle club, which was thriving. Mr. G. Spencer Hawes replied with a humorous speech, and Mr. L. Wilde proposed "The Artistes," for whom Mr. J. H. Heathman responded. Mr. Heathman was in charge of the excellent musical programme, which was rendered by members of the League, and proved that the latter were no less efficient as musicians than they were as riflemen.

Educational Notes.—An announcement is made in our advertisement pages regarding a course of 12 lectures on "The Design of Turbo-Generators," to be delivered by Prof. Miles Walker at the City and Guilds (Engineering) College, South Kensington, commencing on February 12th.

A site for the proposed Engineering Laboratory at Oxford has been obtained outside the park. The original proposal to erect it in the University Park met with strong opposition.

Fatality.—A correspondent writes:—"While Edward Blanched was engaged, on Tuesday night, wheeling a motor-car into a shed, the car touched a live wire, and the man received such a severe shock that he died on the way to the hospital."

Osram and Robertson Social and Athletic Club.—The Fancy Dress Dance of this club was held at Brook Green, Hammersmith, on Saturday last, and was a great success. Dancing commenced at 7 o'clock, and despite the inclement weather, about 300 people were present. The music was rendered by Mr. F. Windett's scarlet orchestra. The M.C.'s were Messrs. Pluck and Minson. Prizes were offered for the best fancy costumes, and the judging resulted as follows:—

Ladies.—First, Miss Palombo, "Lady Gainsborough"; second, Miss Brayshaw, "Indian Lady"; third, Miss Bignell, "Charles I"; fourth, Miss Ritchie, "Pompadour."
Gentlemen.—First, Mr. Woodward, "Skipper"; Mr. Cook, "Cowboy."

The prizes were presented by Mrs. C. Wilson, to whom a hearty vote of thanks was accorded, and Mr. Wilson, on behalf of Mrs. Wilson and himself, suitably replied. Amongst the company were:—Mr. and Mrs. H. Hirst, Mr. M. Railing, Mr. F. Sells, Mr. and Mrs Sheppard. The party broke up about midnight, after having spent a very enjoyable evening.

Royal College of Physicians.—*Nature* states that the Goulstonian Lectures, to be delivered by Dr. A. J. Jex-Blake on February 25th and 27th and March 4th, will deal with "Death by Lightning and Electric Currents."

THE POWER STATION OF LIENFOS, NORWAY.

[BY OUR BERLIN CORRESPONDENT.]

While the abundant water power of Norway is used extensively for the supply of light and power, and more recently for railway operation, many of the large waterfalls situated in the interior of the country would have had to remain idle but for the extraordinary industrial developments brought about by the advent of new processes for the production of calcium carbide, the fixation of atmospheric nitrogen and the manufacture of iron and steel in the electric furnace. In Telemarken, in particular, where local conditions are especially favourable, a large number of plants have already been installed. A natural lake, the Mjösvand, situated at an altitude of 902 metres, and having an area of 41 sq. km., forms a gigantic reservoir which is capable of supplying up to 50 cb. metres of water per second continuously throughout the whole year. The water flows through the power stations Rjukan I, Rjukan II (under construction), Svaelgfos, Lienfos, Tinfos and Skaatfos, so that one reservoir supplies six power stations, a number to be even increased later on by the use of other falls. These favourable local conditions can be expressed in figures by stating that the cost of electrical energy, including the purchase of the site and the building of the station, only amounts to 100-125 marks per H.P.-year.

The Power Station of Lienfos.

It is intended in the following to give a short description of the electrical equipment of the Lienfos works, situated 3 km. above Notodden, on the River Tin, which was supplied by the A.E.G. This power station, like the Rjukan works and Svaelgfos power station, belongs to the Hydro-Electric Nitrogen Co. (Hydro-Elektrisk-Kvaelstof-Aktieselskab), which manufactures nitre and by-products in its factories at Notodden and Saaheim.

In the Lienfos power station, high-pressure current at 50 cycles is produced directly by the generators and passes on to the transmission lines without further conversion. The electrical equipment comprises two continuous-current exciters driven by small turbines, four large three-phase generators, cables leading to the switchgear, the switchgear itself with the apparatus and oil switches for the four generators and four transmission lines, the bus-bars and the lightning arrester plant, as well as the switchboard and the lighting installations. Further, in the switchgear, branches have been provided to the Svaelgfos sub-station of the Tinos railway, as well as to the station transformer. The connections are so designed that each machine can work separately on the transmission line to which it belongs or in parallel with the other machines on to the transmission lines over the bus-bars. For this purpose the bus-bars are so arranged that they can be cut off by isolating switches from the junction points of the machines and transmission lines. Each pair of three-phase transmission lines is carried on one row of poles. The main conductors are arranged in a hexagon, above which a smaller neutral wire is led which is earthed at the receiving station. This wire can carry the neutral wire currents of two adjoining machines, but two neutral wires can also be connected up in parallel by means of special bus-bars. They are only provided with isolating switches and not with oil switches.

Interior of Lienfos Power Station.

Each exciter has an output of 300 kw. at 230 volts and 400 r.p.m., and suffices for the excitation of all four generators. By switching out the shunt regulator of the exciter which happens to be running, the excitation can be cut off from the power station in the event of a dangerous breakdown.

The four generators, coupled to the turbines by flange

couplings, are each designed for an output of 6,600 K.V.A. at $\cos \varphi = \cdot 6$, and for a pressure of 10,000 to 11,000 volts at 50 cycles and a speed of 187·5 R.P.M. The rotors, which are tested up to excess speeds of 80 per cent., have cast-steel rims into which the poles are dovetailed; the latter have bare copper windings and oblique pole shoes. The semi-enclosed stators are constructed in four parts with removable feet, and have former-wound coils laid in open slots in three layers. The stators are mounted in the pits on four rollers on which they can be turned completely round. A maximum temperature rise of 40° C., a test voltage of 22,000 volts and an efficiency of 93·5 per cent. were guaranteed. The cooling air, driven into the machine radially by means of fan rings on both sides, is led through the back of the stator to the generator pit, which is covered in. From here it passes into the open air through two air passages each having a section of 1 sq. metre, which are provided with regulating shutters. The ventilating action is very powerful and sets up an appreciable partial vacuum in the dynamo-room when the windows are closed, so that a single door leading into the open air can only be opened with difficulty. The regulating shutters placed in the air passages are completely closed in winter; the air then re-enters the dynamo-room for heating purposes, through gratings above the air passages and also through openings in the backs of the stators.

The field regulators are fitted with remote control, and by means of a contact arrangement can be controlled both separately and simultaneously in parallel by a single manipulation. The controlling gear works in such a manner that the contacts can only remain stationary with the broad surfaces covering one another. In order to avoid burns, the contacts are provided with additional sparking contacts and magnetic blow-outs. The controlling gear is switched out automatically in the end position. It should also be mentioned that the exciter switches of the generators are electrically interlocked with the field regulators, so that they can only be opened when the regulators are switched out and the generators are not excited.

Two four-core cables arranged in parallel lead the three

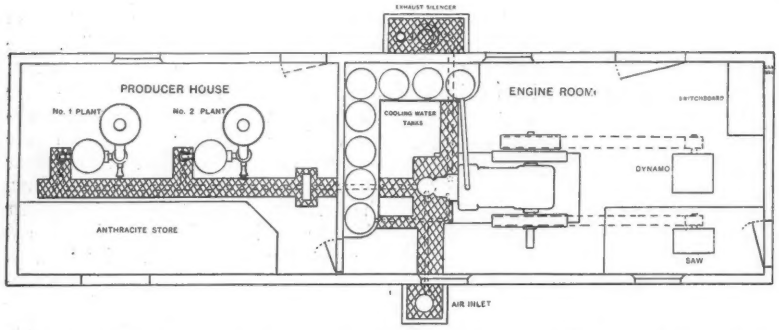


Fig. 1.—Arrangement of Generating Plant at Glenquay Reservoir (See p. 225).

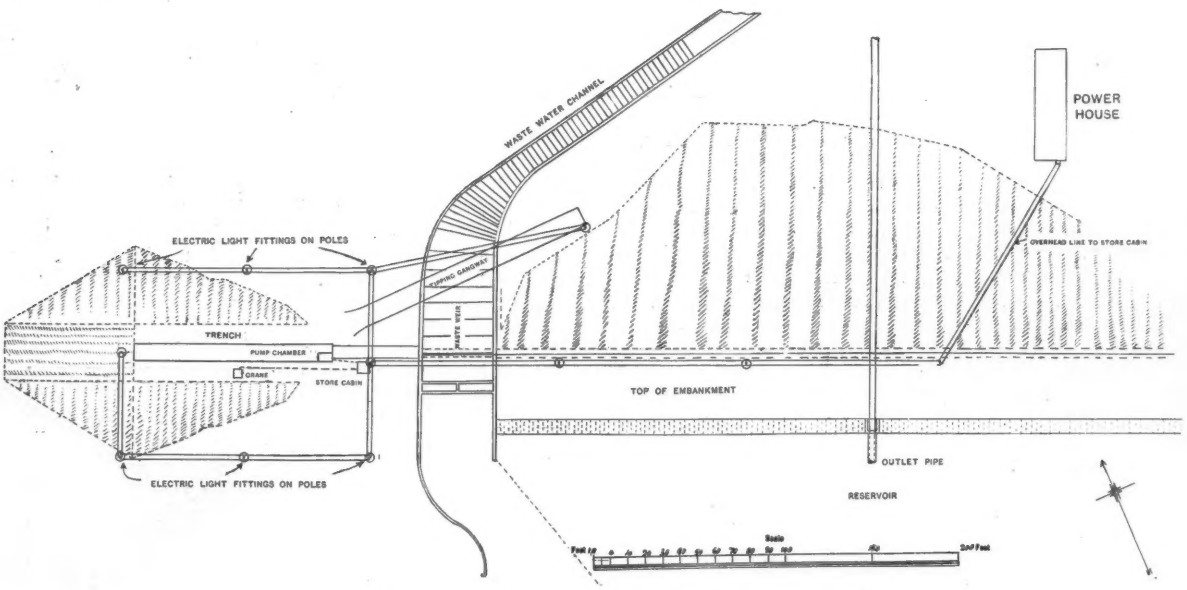


Fig. 2.—Plan of Works at Glenquay Reservoir (See p. 225).

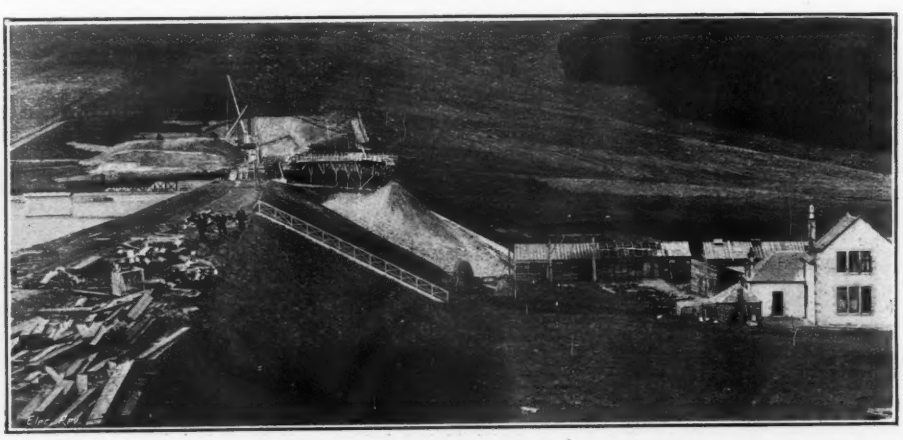


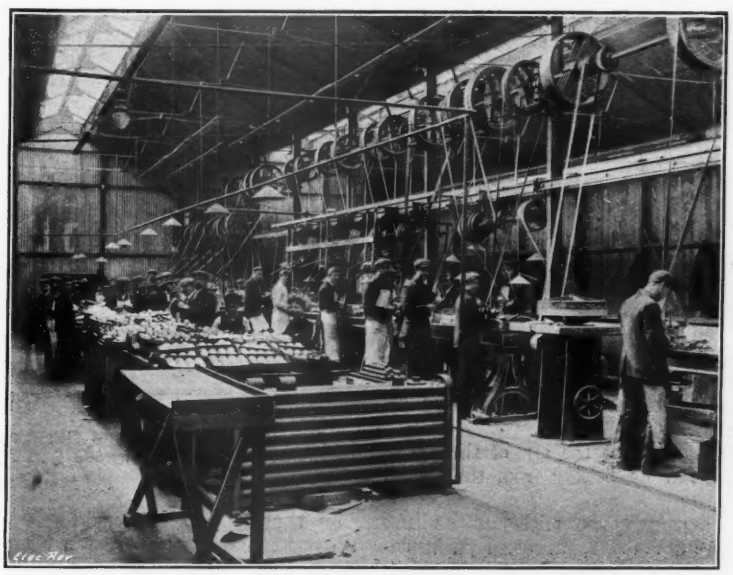
Fig. 3.—View of Works, Glenquay.

phases and the neutral wire from each generator to the end sealing boxes of the switchgear, whence the conductors are carried on in the form of bare copper rod. The phases are kept separate throughout the entire switchgear. The oil switches each consist of three remote-control separate switches coupled by chains. Smooth insulators and concentric terminals are employed everywhere, and impart a very pleasing appearance to the installation.

Tests made on delivery gave very favourable results. Although the area of the air outlet is very much reduced in winter, the guaranteed temperature rise was adhered to. The efficiency was found to be 1·3 per cent. better than the guaranteed figures, and amounted to 94·8 per cent. at $\cos \phi = \cdot 6$, so that the high efficiency of 96·8 per cent. was attained with phase coincidence.

ELECTRICITY IN CONSTRUCTIONAL WORK.

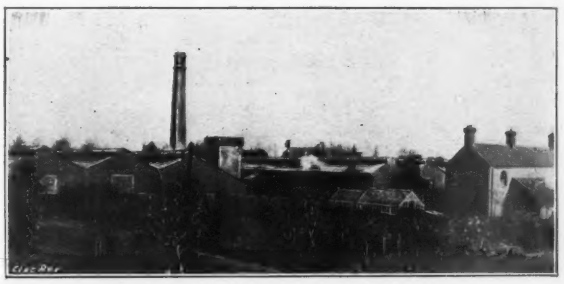
The supply of labour is of vital importance in the carrying-out of constructional work, and will often decide whether a contract shall prove profitable to the contractor or not, and whether he will be enabled to adhere to the specified time of completion. In this article we do not intend to disparage the substitution of mechanical power, which has hitherto advantageously superseded manual labour to a considerable extent with the aid of comparatively small and inefficient steam plant, but, as a general rule, we consider the application of electricity obtained from a central source of power by means of connection to the mains of a supply authority in the neighbourhood, or by the equipment of a power station to suit requirements, to be much preferable as regards both convenience and economy in working.



Turning and Polishing Shop, Crystalate Co.'s Works (page 227).

View in Press Shop, Crystalate Co.'s Works (page 227).

No better results in this connection have been obtained than in the working of pumps—results, indeed, unattained by any other method of transmission, because of the steady load on the motor. A further recommendation for this duty is the mobility of the pumps and motors, as, the energy being transmitted by cables, it is obvious that very little work is involved in removing the pumps to new positions as found necessary.



The Crystalate Manufacturing Co.'s Works, Tonbridge (page 227).

One of the most recent instances of the use of electricity in contracting is to be found in the work now being completed at Glenquay Reservoir, in Perthshire. This undertaking was carried out three or four years ago to provide storage for the water supply to the Southern District of Fifeshire, and particularly in anticipation of the increased demand likely to be created by the Naval Base at Rosyth. About 18 months ago it was found necessary to extend the puddle trench of the retaining bank into the hill at the east side, with a view to increasing the capacity of the reservoir, which has been planned to provide double storage at any future time by raising the existing bank by 11 ft.

The enterprising contractors—Messrs. Wilson, Kinmond and Marr, Ltd., of Glasgow—were entrusted with the extension, and on the advice of their consulting engineers, Messrs. James E. Sayers and Caldwell, of Glasgow, decided to provide generating plant in a position accessible for the easy delivery of fuel, the power being supplied to the pump, crane, &c., by means of an overhead transmission line.

The position of the power house in relation to the work can be seen in fig. 2, on the opposite page, while the plan, fig. 1, shows the general arrangement of the generating plant.

The gas engine and suction-producer plant were manufactured by the National Gas Engine Co.; the engine is capable of giving 75 B.H.P. maximum and 68 B.H.P. constant working load on suction gas of 135 B.TH.U., when running at 210 R.P.M. The engine is provided with magneto ignition and compressed-air starter.

Owing to the continuance of operations night and day during the execution of the contract, double producers and scrubbers were provided, which are connected together; but as each is capable of taking three-quarter duty, they are so arranged that either plant can be disconnected to allow of the other producer being relined with firebricks at intervals. A motor-driven fan is fitted to one producer for starting.

A Corner of the Press Room in the Crystalate Co.'s Works.

The dynamo, of 40-kw. capacity, manufactured by the Edison & Swan Co., is compound wound to generate 135 amperes at 300 volts and 800 r.p.m., and is connected by belting to the engine pulley.

A circular saw is accommodated at the end of the power house building, and is driven by belting from the engine fly-wheel.

The supply of electrical energy is transmitted to the bank workings by overhead bare conductors, supported on insulators fixed to poles and entering buildings through porcelain tubes. Separate cables radiate from distributing boards in a store cabin adjoining the excavations for the supply of the pump, crane and lighting.

View in the Tool Shop, Crystalate Co.'s Works.

As the growth of water was uncertain, one pump was supplied in the first instance, and has proved sufficient to deal with the amount of water in the trench.

The centrifugal pump and motor combination, manufactured by Weise & Monski, will deliver 300 gallons of water per minute against a total varying head of from 50 to 190 ft. The pump delivery to the 5-in. rising main pipe column, fitted with a retaining valve, is throttled at the sluice valve as required to keep the quantity of water normal during sinking operations at reduced head. The 25-h.p. motor, running at 1,700 r.p.m., is of the shunt-wound protected type for operating at 250-300 volts, and suitable for driving the pump at full load without destructive heating. Although the pump was used intermittently, spare impeller parts and a motor armature were available to ensure continuity of service, but it is particularly gratifying to know that neither have so far been necessary.

A 3-ton electric derrick crane, by Messrs. Butters Bros., lifting at the rate of 80 to 120 ft. per minute, is fitted with a 60-ft. steel lattice jib, made in two portions for convenient delivery and erection. A 12-b.h.p. motor of the enclosed reversing type, series-wound for 250-300 volts at 700 r.p.m., is fitted to this crane, and a tramway type controller with magnetic blow-out and suitable resistance is mounted alongside. The crane has handled fully 10,000 cb. ft. of earth and rock excavations, besides the necessary timbering, &c.

The Rolling and Mixing Department, Crystalate Co.'s Works (p. 227).

Aerial conductors for electric lighting are supported on porcelain insulators fixed to cross-arms on poles spaced about 20 yards apart, the connections being taken from these conductors to 24 electric lamp fittings fixed to poles by clamping rings underneath.

The erection of the plant and wiring was carried out by the Harland Engineering Co., and Messrs. Telford, Grier and MacKay.

During the 18 months the plant has been in operation only 55 tons of Polmaise anthracite (washed singles), costing £56 12s., including delivery charges, was consumed by the producer plant.

The above instance of the application of electricity to contracting work is sufficient to warrant the special consideration of its further development by firms who carry out the erection of large buildings, the driving of tunnels, the excavation of sewers, and other large public works necessitating the operation of lifts and hoists, concrete mixers, derricks, and other contracting appliances.

CRYSTALATE IN THE MAKING.

IT is probable that very few of our readers require a lengthy introduction to Crystalate, a substance which has been widely applied during the past few years, both industrially and for sporting and other purposes. In the industrial sphere, its electrical uses are very numerous; in the world of sport and pastime its use for billiard and bagatelle balls is too well-known to need description, while it is also largely employed in the making of gramophone records, dominoes, &c.

The Crystalate Manufacturing Co.'s works are situated about five miles from the old town of Tonbridge, Kent, amidst surroundings which certainly do not suggest manufacturing operations, although some 300 workpeople are employed there. Broadly speaking, the company's product is divided into Crystalate, a material which has as many as 30 different compositions and can be made in any colour, and Crystalate Star Grade, a fireproof black or white insulating material specially produced for electrical purposes. Both classes of material are very largely used for switch handles, bases, covers, bushes, conduit fittings, telephone mouthpieces, receivers and similar things, all over the world, but particularly in Germany.

The Star Grade is a new material only recently put on the market, and an expensive plant has been installed for its production, the company having the sole manufacturing rights for the whole of Europe. It is made in several grades for moulding, machining and sheets, and differs from nearly all other insulating materials of the kind, in that it is unaffected by high temperatures, non-hygroscopic, has a high insulation resistance, and is both tough and strong.

A Faraday House test, for instance, gave a specific resistance of 113,000 megohms; a breakdown voltage of over 7,000 volts on a sample ·351 cm. thick; a percentage absorption of water after 48 hours' immersion of ·44; and showed that heating in a Bunsen flame, and in a crucible, to 680° F. had no effect on it.

A special department is given up to the preliminary mixing of the raw constituents of the Star Grade Crystalate, which subsequently passes to a hydraulic press room, where it is measured preparatory to moulding, an operation carried out in special dies, and under considerable pressure. A number of large and small presses are employed in this work, the largest being a 1,200-ton press used in the manufacture of slabs, &c., and these are worked from a hydraulic pumping plant with two 100-ton accumulators.

From the press room the moulded articles pass to gas-fired furnaces, where, placed in racks, they are subjected to a very high temperature for periods up to 24 hours, and emerge practically fireproof.

The next step is "finishing," the rough fired pieces being machined, ground, polished, &c., as required for the trade.

The mention of dies reminds us that the company has a special tool shop for the production of the various dies, moulds, &c., required in the works. This department is fully equipped with machine tools, &c., for the cutting and working of the steel slabs from which the dies are produced; this class of work is a speciality of the company, which has, of course, had considerable experience both as a maker and user of dies.

So far we have not referred to the manufacture of ordinary grade Crystalate, the better known product of the company, which differs in process from that described. In this case the preliminary mixing of the raw ingredients is followed by calendering, four sets of steam-heated calenders being employed in this work; the resulting product passes to a press room where upwards of a hundred presses are continually in use, moulding the numerous articles for which ordinary Crystalate is employed. These, of course, include a great variety of electrical parts, as well as billiard and bagatelle balls from ½ in. to 3 in. in diameter, gramophone records, dominoes, bottle stoppers, &c. The company's record business has developed very much recently, and considerable extensions are now being made to cope with it. In the course of our visit we were shown the depositing shop, where the matrices are obtained from the original wax records; these, after being soldered on to copper plates and nickelled, form the dies for use in the Crystalate moulding process, which subsequently takes place in the press shop.

The billiard balls, after leaving the press shop, are subjected to very high pressure in enclosed cylinders, and subsequently are turned and buffed preparatory to packing, &c., the latter department being provided with a box-making plant.

The finishing process, of course, also applies to ordinary Crystalate electrical goods, which are scraped and buffed and take a very high polish; in the case of small turn switches, such as are used on the Continent, the thumb piece is moulded on to the spindle, and in the same way Crystalate is moulded on to brass screw threads, where these are desired.

The various operations carried on demand a considerable amount of power, and three steam and three suction-gas engines, varying from 50 to 250 H.P., are in use. The works are lighted electrically, and in several of the shops the Cooper-Hewitt mercury vapour lamp is in use.

In conclusion, we are indebted to Mr. Chas. Davis, managing director of the company, for an instructive visit, affording us an insight into an industry which, though of itself little known, is relatively of great interest to electrical engineers. On pages 225 and 226 we give a number of views of the workshops.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Owing to the termination of the electrical engineer's (MR. C. E. SAVAGE) contract, at the end of last month, temporary arrangements have been made by the Dudley T.C. for the continuation of his services as electrical engineer, giving not less than one-half or more than two-thirds of his time, payment to be made at the rate of £25 per month. These terms are to be continued until the day of the transfer of the undertaking takes place, Mr. Savage being retained afterwards for the purpose of inspecting the cost and quantities consumed on the street lighting contract, and for the examination of the tramway plant under the lease, at an annual fee of £21.

The assistant borough electrical engineer of Poplar (MR. W. INNES) has resigned his position as from January 31st last in order to enter private business. As a consequence the Electricity Committee have decided to discontinue this office and to give more prominence to the managerial side of the department. It is proposed that there should be four departmental officers directly responsible to the chief engineer and manager, viz., assistant manager, station engineer, mains engineer and sales manager. MESSRS. TATE, managerial clerical assistant, V. H. CRUICKSHANK, station superintendent, and E. R. INGRAM, mains superintendent, have been appointed to the three first mentioned positions at salaries of £250, rising by annual increments of £12 10s., to £300 per annum, in the case of F. Tate, and £212 10s. per annum, rising by annual increments of £12 10s., to £300 per annum, in the case of the two other appointments.

MR. SAMUEL WILLIAMS, late burgh electrical engineer in Motherwell, has been appointed to a similar position in Wishaw. There were 46 applicants for the vacancy. Mr. S. Williams resigned the post of burgh electrical engineer for Motherwell in May, 1911, since when he has been suffering from acute rheumatism and unable to attend to business of any kind. We are glad to learn that he has now sufficiently recovered to take up the Wishaw appointment.

The salary of MR. J. W. SPEIGHT, station superintendent to the Leyton undertaking, is to be increased from £200 to the maximum of £250, by annual increments of £10.

The salary of the deputy borough electrical engineer of Salford is to be advanced by £30 from April next, in lieu of £25 from April, 1914, and the salary of the mains engineer by £30 instead of £10.

At the Barrow T.C. meeting on Monday, after some discussion, the salary of the borough electrical engineer, MR. H. R. BURNETT, was increased from £500 to £550 per annum. The salary of MR. J. AIREY, chief clerk and storekeeper, was increased from £125 to £135 per annum, with two further annual increases of £10 and £5 respectively up to £150 per annum. MR. H. R. BARNWELL, works superintendent, was advanced from £180 to £190, with a further increase of £10 twelve months hence to a maximum of £200; and MR. J. F. HESLOP, mains superintendent, had his salary increased from £165 to £180 per annum, with further increases of £10 per annum to a maximum of £200.

Todmorden T.C. has now appointed MR. JOS. BOYCE, for 12 years assistant electrical engineer to Darwen Corporation, as chief electrical engineer and manager of the destructor department. There was a large number of applicants. Mr. Boyce served six years' apprenticeship with Messrs. Charlesworth, Hall & Co., electrical and general engineers, of Oldham. Subsequently he was with Mr. G. St. J. Day, an electrical engineer in private practice at Oldham, and Messrs. G. L. Adamson & Son, of Rochdale, where much experience was gained in the application of electric power for driving mills, works and mines.

MR. FRED RILEY, of Rawtenstall, has declined the appointment of electrical engineer to the Todmorden Corporation.

MR. DUNROSE, of the Stoke-on-Trent electricity staff, has been presented by his colleagues with a case of cutlery on his marriage.

Newport (Mon.) Education Committee has appointed the borough electrical engineer, MR. A. NICHOLS MOORE, as teacher of electrical engineering at the Technical Institute, in place of Mr. Whitehouse, who has resigned.

MR. C. E. SAVAGE, chief electrical engineer to the Dudley Corporation, has accepted a position under the Earl of Dudley at Baggeridge Wood Colliery.

The General Purposes Committee of Blackburn Corporation have adopted a scheme involving an increase of £1,178 in the salaries of Corporation employés, with further increases, when the maximum is attained, amounting to £1,457. In the case of employés other than clerks, there is an advance in the first year of £730, including the electricity department, £75; tramways department, £538. The increase in the tramways department includes a farthing per hour all round for motormen, conductors, and depôt employés over 21 years of age. In all cases where holidays with pay have been less than five days, it is recommended that they be increased to that number.

MR. JOSEPH S. AINSWORTH, who was chief assistant at the electricity works of the Monmouth Corporation, and in a similar position with the Brynamman and District Electric Light and Power Co., South Wales, has resigned from the staff of the electricity works of the Gloucester Corporation, so as to accept an important position in New Zealand in connection with a new water-power scheme. On behalf of the staff of the Gloucester electricity works, Mr. Corson, the city electrical engineer, presented MR. AINSWORTH with an oval-shaped glass-sided travelling timepiece in leather case. Mr. Ainsworth sails on February 14th.

The Electricity and Tramways Committee of the York T.C. has appointed MR. L. M. JOCKELL, of Middlesbrough, as fourth engineer-in-charge at the electricity works.

On the occasion of his leaving Ilkeston to take up a similar appointment at Bexley Heath, MR. H. P. STOKES was entertained to dinner on January 22nd, by a number of the members of the Council and prominent townspeople. After the dinner, and between items in the programme, the Mayor (Councillor F. P. Sudbury) presented Mr. Stokes with a silver tea urn, and spoke of the very high esteem in which he was held, of the hard work he had done, and of the satisfactory state in which the two depart- now were, as compared with the time when he took over the management. At a meeting of the employés, the chief inspector asked Mr. Stokes, on behalf of the employes, to accept a silver cake basket.

General.—At the annual social of Darwen tramway employés on January 30th, MR. R. W. SMITH SAVILLE was presented with a silver rose-bowl by the Corporation tramway staff upon his retirement from the post of engineer and manager. Alderman James Tomlinson made the presentation, which was given in recognition of the cordial relations which have existed between the recipient and the staff during the past 12 years.

The *Australian Mining Standard* states that MR. C. H. MERZ, before leaving for England, was entertained at luncheon by the Victorian Premier, Mr. Watt, and speeches were made. Most of the members of the Ministry, several members of both Houses, and officers of the Railway Department, were present.

We are officially informed of the following changes in the boards of the following companies:—

Central London Railway.—Lord Knollys, Lord Rathmore and Mr. Robert Fleming have resigned, and Lord George Hamilton, Colonel Sir Herbert Jekyll, and Mr. A. H. Stanley have been appointed in their places. Mr. A. H. Stanley will be appointed managing director of the company. Mr. H. F. Parshall has tendered his resignation as a director. Mr. A. H. Stanley has been appointed managing director. Hon. Sydney Holland will be elected to fill the vacancy. Lord George Hamilton will become chairman of the board.

City and South London Railway.—Mr. J. F. S. Gooday, Mr. S. Barclay Heward and Mr. Edwin Tate have resigned, and Admiral Sir Cyprian Bridge, Mr. T. C. Jenkin (who has resigned as general manager of the company), and Mr. A. H. Stanley, have been appointed in their place.

London Electric Railway.—Lord George Hamilton resigns as chairman of the company, the resignation taking effect after the half-year meeting held last Friday, when Lord Farrer was appointed in his place. Lord Knollys has been elected to a seat on the board.

Messrs. T. L. Miller, H. W. Wilson, and H. V. Pegg (Miller, Wilson & Pegg, consulting mechanical and electrical engineers, Liverpool and Belfast) have dissolved partnership. Mr. T. L. Miller will attend to debts at Tower Buildings, Water Street, Liverpool.

Congratulations to Past-President DR. ZIANI DE FERRANTI and Mrs. Ferranti on the birth of a daughter on January 29th, at Baslow, Derbyshire.

MR. E. J. ARNOLD, until recently fittings department manager for the General Electric Co. in Liverpool, has severed his connection with the company, in order to start in business upon his own account in partnership with MR. I. E. POYSER, as the Liverpool Fittings Co., at 55, Renshaw Street, Liverpool.

The *Times* says that SIR HENRY NORMAN has been elected an Associate of the Institution of Electrical Engineers.

The wedding took place at St. John's Church, Blackpool, on January 30th, of MR. C. G. NICKSON, an electrical engineer, younger son of the late Ald. John Nickson and Miss Ethel Eyre.

MR. W. C. JEARY, the general manager of the Magic Appliances, Ltd., has been elected to a seat on the board.

MR. GEO. H. GYTON having secured an appointment with Messrs. J. M. Doughty & Son, Ltd., of Clerkenwell, is resigning his position with Messrs. D. H. Bonnella & Son, for whom he has acted as London representative.

MR. ALVIN E. LOE, who has been manager of the General Electric Co.'s Telephone Department (Glasgow Branch) for several years, has resigned his position. Mr. Loe will continue to place his specialised knowledge on telephony and allied subjects at the service of his friends at (for the present) 43, Apsley Street, Partick, W. Glasgow.

Obituary.—THE EARL OF CRAWFORD.—We deeply regret to record the death, which occurred on January 31st at Cavendish Square, London, of the Earl of Crawford and Balcarres, Kt., F.R.S., at the age of 66 years. On Tuesday a memorial service was held at the Chapel Royal, St. James', on Tuesday, 4th inst., when the Institution of Electrical Engineers was represented by Mr. Walter Judd (vice-president), Mr. Robert Hammond (honorary treasurer) and Mr. P. F. Rowell (secretary). The late Earl, who was one of the founders of the Institution, was, at the time of his death, the oldest surviving officer of the Institution, having been, as Lord Lindsay, the first vice-president of the Institution, holding that office for three years—1872-3-4—during the presidencies of Sir William Siemens, Frank Ives Scudamore and Sir William Thomson. On the occasion of the special meeting of members of the Institution on June 30th, 1908, when the purchase of the present home of the Institution was sanctioned, the following letter from the deceased Peer was read to the members:—

I regret that I shall not be able to attend the meeting called for the 30th. I must, however, write a line of congratulation to the Institution on their acquisition of so fine a home, especially when I think of the first thoughts of its formation in my old laboratory in a mews behind Green Street, Park Lane, all now swept away, and of the first soiree which was held in my laboratory in Greek Street, Soho. I believe that now I am the senior surviving officer of the Society, as I was Vice-President to Sir William Thomson (one of our first Presidents), and as such I offer my congratulations.—Very faithfully yours,
CRAWFORD.

The February number of the *Faraday House Journal*, which has been issued this week, contains an article on the deceased peer, from which we gather that he had been closely associated with Faraday House for the last 23 years. It is stated that as far back as 1869, Lord Lindsay (as he was then called) had an electrical laboratory in Eaton Place, where he continued many of Faraday's researches. "Some of his original apparatus is still in everyday use in the laboratories at Faraday House. It was at Eaton Place that in the first inception of the Society of Telegraph Engineers was made, a society which is now called the Institution of Electrical Engineers. Lord Crawford has told how he and Cromwell and Alfred Varley first discussed the project, and how anxious they were that Prof. Sir William Thomson (Lord Kelvin) should be their first President. . . . In 1878 he was elected a Fellow of the Royal Society, and became for the first time President of the Royal Astronomical Society—a post which he filled with great distinction. In the same year (1878), he and Lord Rayleigh were elected Honorary Members of the Institution of Mechanical Engineers." For very many years, and until the time of his death, he was closely identified with the London Electric Supply Corporation, Ltd., as chairman, but he was constantly engaged in a battle against ill-health.

DR. GUSTAF DE LAVAL.—We regret to record the death which occurred at Stockholm last Sunday of Dr. G. de Laval, the inventor in 1889 of the well-known high-speed turbine which bears his name, and which may be described as laying the foundation of the impulse part of the modern turbine which is a combination of the inventions of de Laval and Parsons. The de Laval turbine is used for small and moderate powers in various electrical and other works abroad, and for a number of private works installations in this country. The English rights were held by Messrs. Greenwood & Batley, Ltd., of Leeds, whose works installation comprised a number of these turbines. The deceased gentleman was 67 years of age.

MR. THOS. BLANE passed away, on January 30th, at his residence at Blackpool, at the age of 62 years. Deceased was chairman of Blackpool, St. Annes and Lytham Tramways Co., and a director of other concerns.

A correspondent says that much regret was felt in Newport (Fife) at the death in Winnipeg, of a well-known native, MR. DAVID C. JACK, an electrical engineer and a partner in the Hub Welding Co., Winnipeg. Mr. Jack was only 30 years of age.

NEW COMPANIES REGISTERED.

Portable Electric Light Co., Ltd. (126,782).—This company was registered on January 27th, with a capital of £10,000 in £1 shares, to carry on the business of dealers in electrical and mechanical novelties, &c. The subscribers (with one share each) are:—M. Goodfellow, 6, Shaftesbury Avenue, New Barnet, secretary; A. Herrmann, 39, Norfolk Avenue, Stamford Hill, N., clerk. Private company. The number of directors is not to be less than two or more than five: the subscribers are to appoint the first. Solicitors: J. and M. Solomon, 58, Finsbury Pavement, E.C. Registered office, 120, Shaftesbury Avenue, London.

Baldur Engineering and Supply Co., Ltd. (126,901).—This company was registered on February 1st, with a capital of £6,500 in £1 shares (3,000 preference), to carry on the business of gas, electrical and mechanical engineers, manufacturers of and dealers in gas and electrical fittings, accessories, conveniences and apparatus, &c. The subscribers (with one share each) are:—G. A. Hattin, 51, Morland Buildings, Earl Street, Westminster, clerk; A. G. Ferris, 104, Torrian's Avenue, Camden Road, N.W., clerk. Private company. The number of directors is not to be less than two or more than five; the first are J. T. Grein (chairman) and H. C. Cayley (both permanent); qualification, 500 shares; remuneration of chairman, £80 per annum. Registered by Strong & Co., 70, Gracechurch Street, E.C.

Ardea Vulcaniser Syndicate, Ltd. (126,762).—This company was registered on January 27th, with a capital of £1,000 in £1 shares, to take over from R. K. Hearn the benefit of certain inventions relating to electric heating apparatus, and to carry on the business of manufacturers of and dealers in vulcanisers, electric heaters, &c. The subscribers (with one share each) are:—R. K. Hearn, Netherton, The Downs, Wimbledon, engineer; E. F. Hearn, Netherton, The Downs, Wimbledon, gentleman. Private company. The first directors are R. K. Hearn and E. F. Hearn (both permanent). Solicitors: Stanley Evans & Co., 20-22, Theobalds Road, W.C. Registered office, 318, King Street, Hammersmith.

Pritchard, Foxcroft & Co., Ltd. (126,838).—This company was registered on January 29th, with a capital of £1,000 in £1 shares (500 20 per cent. cumulative shares), to carry on the business of electrical, telegraph and telephone engineers, scientific and optical case makers, electricians, advertising agents, manufacturers of kinematograph films and apparatus, &c. The subscribers (with one share each) are:—H. Pritchard, Empress Works, Shacklewell Lane, Dalston, N.E., engineer; S. H. Guttenberg, 60, Grosvenor Road, Canonbury, N., jeweller. Private company. The number of directors is not to be less than two or more than five; the first are H. Pritchard and S. H. Guttenberg (both permanent). Registered office, Empress Works, Shacklewell Lane, Dalston, N.E.

Gereg, Ltd. (126,852).—This company was registered on January 30th, with a capital of £3,000 in 1s. shares, to carry on the business of electricians, engineers, suppliers of electricity, manufacturers of and dealers in clocks and time-registering and automatic machines and appliances, &c. The subscribers (with one share each) are:—E. H. Campion, B.A., 23, Old Broad Street, E.C., solicitor; E. R. Baines, Green Street Green, Orpington, accountant. Private company. The number of directors is not to be less than three or more than seven; the subscribers are to appoint the first: no qualification required: remuneration according to profits. Registered by H. G. Campion and Co., 23, Old Broad Street, E.C. (solicitors).

Pernambuco Tramways and Power Co., Ltd. (126,731).—Registered January 24th, by Norton, Rose, Barrington & Co., 57½, Old Broad Street, E.C. Capital £1,000,000 in £1 shares (400,000 preference). Objects: To acquire or construct, develop and extend any tramways, railways, or light railways, to equip, work, and maintain the same with electrical, steam, animal, or other power, &c. The signatories (with one share) are:—E. T. Washington, 100, Westmount Road, Eltham, Kent, clerk; J. A. J. Scott, 85, Moring Road, S.W., clerk; H. L. Hamlyn, 80, Bestrevor Road, Fulham, S.W., clerk; H. Harper, 10, Penerley Road, Catford, S.E., accountant; F. H. Snethurst, 18, Egerton Gardens, Hendon, N.W., buyer; C. M. Plumptre, 68, Underhill Road, East Dulwich, S.E., clerk; M. P. Hewell, 15, Culverden Road, Balham, S.W., registrar. Minimum cash subscription, seven shares. The first directors (to be not less than three or more than seven) are Eugenie Dedsworth, Rio de Janeiro; Follett Holt, 6, Sussex Square, W.; Eugenie G. Filho, Pernambuco; H. K. Heyland, 174, Gresham House, E.C.; Wm. Higgins, Glenafton, Wimbledon, S.W.; Sidney Jones, Paris; and Henri Marechal. No qualification required for first directors; qualification of subsequent directors, £1,000; remuneration, £1,800 per annum, divisible.

Roberts Bros. & Holloway, Ltd. (126,786).—This company was registered on January 27th, with a capital of £1,500 in £1 shares, to acquire the business of electrical engineers carried on as "Roberts Bros." at Bradford, and to adopt an agreement with Mary Agnes Roberts and A. Roberts. The subscribers (with one share each) are:—Mrs. M. A. Roberts, Cragg Cottage, Rawdon; A. Roberts, Cragg Cottage, Rawdon, electrical engineer; E. R. Holloway, 145, Bradford Road, Frizinghall, Bradford, electrical engineer; G. E. Holloway, 145, Bradford Road, Frizinghall, Bradford, cashier. Private company. The number of directors is not to be less than two or more than five; the first are A. Roberts and E. R. Holloway; qualification, 100 shares. Registered office, 3, Nutter Place, North Parade, Bradford. Solicitor, H. H. Duncan, 14, Piccadilly, Bradford.

Price Adjustable Reamer, Ltd. (126,783).—This company was registered on January 27th, with a capital of £1,000 in £1 shares, to take over a patent for improvements in adjustable reamers, taps and the like, to carry on the business of mechanical, electrical, motor and general engineers, manufacturers of and dealers in cycles and motors, &c., and to adopt an agreement with F. Price. The subscribers (with 10 shares each) are:—W. Williamson, Cromwell House, Earlsdon Avenue, Coventry, manufacturer; E. L. Roberts, 28, Gosford Street, Coventry, cycle engineer. Private company. The number of directors is not to be less than two or more than five; the first are F. E. Price, W. Williamson and E. L. Roberts; qualification, £10. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Brown, Boveri & Co., Ltd. (89,167).—Capital, £50,000 in £5 shares (1,500 "A" and 8,500 "B"). Return dated December 14th, 1912 (filed December 17th). All shares taken up, 15s. per share called up on 8,500 "B," £6,375 paid, £7,500 considered as paid on £1,500 "A." Mortgages and charges: Nil.

South London Electric Supply Corporation, Ltd.—Issue on January 21st, 1913, of £1,400 debentures (sold to brokers at 99 per cent.), part of a series of which particulars have already been filed.

Electrical Installations, Ltd.—A memorandum of satisfaction to the extent of £200 on January 16th, 1913, of debentures dated December 5th, 1906, securing £2,000, has been filed.

Blackpool and Garstang Electric Light Railway Co., Ltd. (62,150).—Capital, £10,000 in £5 shares; return dated January 6th, 1913 (filed same date); 361 shares taken up; £4 per share called up; £1,707 paid (including £323 received on application for further shares not allotted); £60 remains in arrears. Mortgages and charges: Nil.

Isaacson & Brown, Ltd.—Particulars of £800 debentures, created January 23rd, 1913; filed pursuant to Sec. 93 (5) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Oriental Telephone and Electric Co., Ltd.—A memorandum of satisfaction to the extent of £1,450, on January 22nd, 1913, of trust deed dated June 28th, 1905, and supplemental deed of acknowledgement dated June 12th, 1907, securing £200,000.

British Insulated and Helsby Cables, Ltd.—The directors have declared a dividend on the 6 per cent. cumulative preference shares to December 31st.

CITY NOTES.

Yorkshire Electric Power Co.

THE directors' report for the year ending December 31st, 1912, to be submitted at the half-yearly meeting at Leeds on February 18th, states that the gross profit on the revenue account for the three years ending December 31st, was as follows:—1912, £12,710; 1911, £12,572; 1910, £11,308. The net profit, after payment of mortgage interest for the same periods, was:— £7,361; £7,784; £6,503. The accumulated profits up to the end of 1911 enabled the company to write off administration and development expenses amounting to £14,047, and to pay the dividend due on the cumulative preference shares, leaving a balance to carry forward of £330, which, added to the profit for the year 1912 of £7,361, gives a total of £7,691; and, deducting the dividend paid on the preference shares to June 30th, 1912, of £2,323, leaves a disposable balance of £5,368. The directors recommend that the balance should be dealt with as follows:—Dividend for the half-year ending December 31st, 1912, at the rate of 6 per cent. per annum on the cumulative preference shares, £2,803; write off the special expenditure during 1911 in connection with generating plant, £1,921, carrying forward £645. The supply for power and light was fully maintained throughout the coal strike, though the additional cost to the company was very considerable. That strike, and the partial breakdown of plant last July, referred to in the last half-yearly report, have greatly retarded the progress of the company and affected its profits by delaying connections to the premises of new consumers from whom important increases of revenue would have accrued in the second half of 1912. Considerable additions have been made to the generating plant at Thornhill to meet the normal increase of business, and that which is expected from agreements already made and others in process of negotiation. During the year there has been considerable capital expenditure on the extension of the distributive system, and the company is now giving a supply over a large area in the West Riding. There has again been an increase in the amount paid for rates, and the company is now paying these in 56 parishes and townships. In accordance with the resolution passed at an extraordinary meeting held on September 17th last, an issue of £50,000 6 per cent. cumulative preference shares has been offered to shareholders, and up to the end of 1912 applications had been received for £20,535 of this capital. On May 20th, 1912, the Yorkshire Waste Heat Co., Ltd., was incorporated under the Companies' (Consolidation) Act, 1908. A generating station is now being erected at Barugh, near Barnsley, and to construct this station an issue of £25,000 of 5½ per cent. first mortgage debenture stock was in November offered to the shareholders of the Power Co. Of this issue £10,460 has been applied for up to December 31st last. The directors anticipate that the whole of both issues will shortly be taken up.

Company Registrations in 1912.—In the course of its usual annual review, the *Investors' Guardian* gives the following among its other statistical returns:—

English registrations.	1910.	1911.	1912.
No. of companies	6,707	5,960	7,095
Electric	2,408,457	3,166,645	7,579,780
Engineering and hardware ..	5,899,442	8,424,402	8,835,757
Gas	1,013,362	838,125	407,900
Motor, cycle and carriage ..	3,293,050	2,721,345	7,253,879
Oil	34,302,397	15,860,820	23,533,182
Railways and tramways ..	9,952,660	5,186,855	3,164,200
Rubber	44,046,045	9,458,775	3,209,965

Torquay Electric Tramways Co., Ltd.—The annual report for 1912 gives the following figures:—Traffic revenue, £28,112, as against £22,635 in 1911; advertising, £278; total receipts, £28,438; expenditure, £17,008; profit balance, £11,755; passengers carried, 4,207,619, compared with 3,594,317 in 1911; car-miles, 626,478, last year 494,468; receipts per car-mile, 10·77d.; 1911, 10·99d.; receipts per passenger, 1·60d.; 1911, 1·51d.; energy per car-mile, 1·97d.; 1911, 2·41d. After paying debenture interest and providing for sinking fund for prior lien debentures, there is a balance, with a "carry forward" of £883 from 1911, of £5,988. A dividend of 3 per cent. on the ordinary shares will absorb £3,599; £1,500 will be allocated to the reserve and renewals fund, and £37 will be carried forward. The year's profit is £2,860 in excess of that for 1911. Considering the wet weather which prevailed last year, the result is regarded as satisfactory. Mr. W. B. Cownie, who has been a director since the formation of the company, has been appointed managing director. The annual meeting was held in London on Wednesday.

Consolidated Diesel Engine Manufacturers, Ltd.—In a report dealing with the progress made by the company since its incorporation, the directors state that many important contracts have been booked, both by the company and its associates, Messrs. Usines Carels Frères. The construction of the Ipswich works has not progressed as fast as was anticipated, owing to various obstacles having to be overcome during the preliminary stages. The activity in the steel trade has caused a certain delay in the delivery of material, but the contracts for steel work were placed before the present inflated prices came into operation. The greater part of the foundations for the buildings is completed, and the structural work is in course of erection. One section of the shops will be built first, and as soon as this is ready a number of the staff will be transferred to Ipswich to carry on the preliminary work upon which they are now engaged either in London or Ghent.—*Financial News.*

Lanarkshire Tramways Co., Ltd.

The meeting of the shareholders of the above company was held on Tuesday at the offices, 83, Cannon Street, London, E.C., Mr. A. R. Monks presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, page 147), said that the capital expenditure for the half-year had only amounted to £726, which had been met to the extent of £500 by the issue of further debentures. The traffic receipts showed an increase for the first half of the year of £568, and for the second half an increase of £1,891, a total of £2,459. The receipts for the first half of the year were largely affected by the coal strike, and they estimated that but for the strike they would have shown a further increase of about £2,500. Advertising and other sundry revenue items were a few pounds in excess of the previous year, which gave them a net gain in the gross revenue of £2,462. Taking the expenses, the power costs showed an increase of £177, all of which was due to higher prices ruling for coal. Traction expenses were £2,287 more than for the previous year, nearly £2,000 of which was due to increased maintenance charges for permanent way and electrical equipment of line. The net increase in expenses was £4,062, so that the gross profits were £1,600 less than for the year 1911. This was offset to the extent of nearly £1,200 by the reduction of their payments to local authorities. For 1911 the payments amounted to £2,892 (this was on a 6 per cent. dividend basis), but as they could only pay 5¾ per cent. for 1912, their payments were reduced to £1,704. The expenses in connection with the Act promoted by the Lanark County Council amounted to £818. They had written this amount off, also £137 for repair shop equipment, loose tools, &c. £9,500 had been transferred to reserve for depreciation, making, with interest, a total addition for the year of £11,448, increasing the reserve to £63,263. The balance of profit available allowed for payment of a 6 per cent. dividend for the half-year, making 5¾ per cent. for the full year, and after reserving £307 for additional remuneration to the directors, they had £1,577 to carry forward to the current year. Having in mind the adverse effects of the coal strike, he thought they would agree that the results for the year were very satisfactory. They had invested during the year £4,987 in trustee securities, making a total investment to date of £21,134. The two matters in dispute with the Lanark County Council, namely, the utilising of money paid by the company for road widenings in building the new road known as Coronation Road, New Stevenston, and the application for Parliamentary powers for the immediate purchase of their undertaking, had been satisfactorily disposed of during the year. The County Council had been granted powers to construct the uncompleted lines authorised by their 1903 order. By an agreement between the County Council and the company, these new lines would be proceeded with shortly, and would be leased to the company on the terms of their paying to the County Council the interest charge on the amount expended on the construction. Under the agreement, the Council, with the other local authorities interested, had an option to purchase the undertaking at any time before 1928 at a price to be agreed upon between the local authorities and the company. If the local authorities did not buy them out within two years from the date of the opening for public traffic of the new lines, they were to purchase from the County Council the new lines at the cost price. No wayleave would be payable in respect of the new lines during the first two years of their operation. To meet the traffic on the extensions, they were ordering 12 additional cars and had also to extend their car-sheds, repair shops, &c. The directors had also decided to run motor-omnibuses, and services would be inaugurated in the near future.

Mr. G. Franklin seconded the motion, and the report was adopted.

Metropolitan District Railway Co.

The ordinary general meeting was held on Friday last at the Westminster Palace Hotel, London, under the presidency of Lord George Hamilton.

The Chairman, in proposing the adoption of the report (see Electrical Review, page 168), said that the six months under review showed progress and some expansion of traffic, but the profits upon the expansion were to a considerable extent neutralised by the rise in the prices of certain articles, notably in that of coal. The amount expended on capital for the half-year was £25,000. The estimate of further capital expenditure was £205,000, and included the following provisions:—New rolling stock—30 additional cars, £67,000; extension to Charing Cross sub-station, including additional converters, £10,400; additional converters in Victoria, Earl's Court, Ravenscourt Park, Acton Town and Hounslow sub-stations, £10,000; flying junction at Earl's Court, £62,000; and electrification of section of District Railway between West Kensington Junction and Earl's Court Junction, £4,000. The gross receipts amounted to £346,655, being an increase of £23,840, or 7·39 per cent. over the receipts for the corresponding half-year. The passenger receipts amounted to £327,236, an increase of £26,611, or 8·85 per cent., while the average receipt per passenger was 1·82d., or an increase of 0·01d. compared with the corresponding period. The expenditure for electric train working amounted to £66,806, as compared with £78,540 in the corresponding half-year, being a difference of some £11,700. The total expenditure for the half-year was £166,200, as against £152,600 for the six months of the corresponding last half-year, showing an excess of £13,600; £6,000 of which was the extra cost of train working, due principally to the increased cost of coal. They consumed about 3,000 tons of coal per week, and the rise of a few shillings in the price per ton caused a substantial increase in this item of their expenditure. The price of coal materially affected their working expenses, and he was afraid there was every indication that during the current year the price of coal would continue to be high. The car-mileage had increased by 403,058, or 5·20 per cent., notwithstanding which the passenger receipts per car-mile were 9·625d., or an increase of 0·323d. over the corresponding period. The percentage of operating expenses to gross earnings was 43 per cent., compared with 41·94 per cent. for the corresponding period. The same sum had been reserved for renewals, namely, £10,000, as for the corresponding period of last year. The balance available for the dividend was £85,694, which was practically the same as that available for a similar purpose last year. This balance they proposed to distribute as follows:—On the 4 per cent. guaranteed stock at the rate of £4 per cent. per annum, £28,714; on the first preference stock at the rate of £4 10s. per cent. per annum, £33,750; and on the 5 per cent. second preference stock at the rate of £2 per cent. per annum, £14,700. This would leave a balance of £8,528 to carry forward. The accounts would have permitted a slight increase in the dividend on the second preference stock, but the directors were of opinion that it was preferable that no increase to their dividends should be made this half-year, but that the carry-forward to the current year should be increased. There were two Bills referred to in the report, one by their company, and the other by the Wimbledon and Sutton Railway Co. The first one provided for the widening of their Fulham extension railway, consisting in the provision of two additional lines of track for a distance of about three-quarters of a mile, and of two island platforms at Parson's Green allowing of the passing of slow and fast trains, which extension when constructed would improve the train working on this branch. The Bill also authorised the Metropolitan Co. and their company to lengthen the platforms of the Aldgate East Station on the City lines so as to allow of the running of longer trains, the Aldgate East platforms being at the present time the shortest on the railway. The important part of the Bill was in connection with the Wimbledon and Sutton Railway. They would remember that this railway was authorised by Act of Parliament in 1910, but no portion of the railway had been constructed. The directors were of the opinion that this railway would serve a very desirable residential district close to London, and that a through service of trains direct from the City to Sutton would be the means of rapidly developing the latter district, and ultimately be to the advantage of the District Railway. The Bill took powers on behalf of the Wimbledon and Sutton Co. for an extension of time for the purchase of lands and the construction of the railway, as well as for additional capital and borrowing powers. Certain changes in the personnel of the staff had occurred during this period. The District Railway was by far the oldest of the various undertakings controlled by the Underground Co. They had the advantage of this maturity in possessing an experienced staff and personnel, many of whom had spent much of their lives in the service of the company, and who took an inherent and genuine interest in the work and well-being of the company. On the other hand, age, time, and death caused greater gaps amongst the heads of departments than was the case with younger companies. Having referred to the retirement of Mr. Whittle, who had been the accountant of the company for 42 years, and to the death of Mr. Soar, an old servant, the chairman concluded by saying that the past six months showed the same steady and continuous expansion which had been characteristic of the reports of the District Railway during the last six years. It was true that high prices, especially those of coal, had interfered with and marred the increased profit which they otherwise would have been able to show. The railway, from its small mileage and from the complicated and hampering conditions which old Acts of Parliament had imposed upon it, could not be expected to show in any half-year, or even in any full year, a revenue advancing by leaps and bounds. Such performances were outside its capacity and limitation, but it had shown and would, he thought, continue to show progress, which though slow was steady and unbroken, a progress not very noticeable in any one half-year, but which by continuous accumulation over a number of years would steadily increase the aggregate dividend and the value of the property of its stockholders.

Mr. Ernest Law seconded the resolution, and the report was adopted.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

British Columbia Telephone Co., Ltd.—10,000 6 per cent. cumulative preference shares of $100 each, fully paid (Nos. 1 to 10,000).

Compania Hidro-Electrica de Tucuman.—£300,000 5 per cent. first mortgage debentures of £100 each.

Mexico Tramways Co.—Further issue of $1,298,000 general consolidated first mortgage 50-year 5 per cent. gold bonds.

The Committee have ordered the undermentioned securities to be quoted in the Official List:—

Cordoba Light, Power and Traction Co., Ltd.—Further issue of 127,553 ordinary shares of £1 each, fully paid (Nos. 472,448 to 600,000).

Rhondda Tramways Co., Ltd.—Further issue of £40,000 5 per cent. first mortgage debentures (registered) of £100 each (Nos. 2,001 to 2,400).

Consolidated Gas, Electric Light and Power Co., of Baltimore.—The directors have declared a dividend of 1½ per cent. on the common stock for the quarter ending March 31st, and 3 per cent. on the preferred stock.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the four weeks ended December 27th, 1912, amounted to 806,132, compared with 656,441 units in the corresponding four weeks of 1911.

Central London Railway Co.

THE directors' report for the half-year ending December 31st, 1912, states that the amount of capital expended during the half-year was £53,148. The following are the financial results of the half-year's working :—

	1912.	1911.	Increase.
Traffic receipts	£131,028	£125,806	£5,222
Miscellaneous receipts	13,427	12,746	681
Gross receipts	£144,455	£138,552	£5,903
Less working expenses ..	76,328	73,696	2,632
Balance to net revenue account	£68,127	£64,856	£3,271

After providing for interest on the debenture stock and other payments, the net revenue account shows that, including the amount brought forward from last half-year, there is an available balance of £85,420, as compared with £83,170 in the corresponding period. After deducting £6,739 for interest on the 4½ per cent. preference stock, there remains a balance of £78,680, out of which the directors recommend the declaration of the following dividends :—Undivided ordinary stock at the rate of 3 per cent. per annum for the half-year ; preferred ordinary stock at the rate of 4 per cent. per annum for the half-year ; deferred ordinary stock at the rate of 2 per cent. per annum for the whole year. These payments will require £51,462, leaving a balance of £27,218. The number of passengers carried, including season tickets, through tickets and the cheap return tickets issued before 7.30 a.m., is as follows :—

Year.	Half-year ending June.	Half-year ending December.	Total.
1910	20,664,896	19,995,960	40,660,856
1911	20,006,287	18,076,996	38,083,283
1912	17,249,169	18,690,033	35,939,202
Total carried			510,902,053

The extension of the railway to Liverpool Street was opened for public traffic on Sunday, July 28th last, and the Broad Street Station booking offices on Thursday, October 10th last. The number of passengers using this extension, and the receipts derived therefrom are considered satisfactory. The proposals of the Underground Electric Railways Co. of London, Ltd., referred to in the chairman's circular letter of December 14th last, having been accepted by the holders of over 75 per cent. in the aggregate of the ordinary, preferred ordinary, and deferred ordinary stock, the offer has now become binding on the Underground Co.

The directors propose, in future, to submit accounts yearly, and hold one ordinary general meeting in January or February in each year. Interim dividends will be declared in the month of July or August.

The Right Hon. Lord Esher retired from the board in October last, and Sir Henry Babington Smith was elected in his place. The meeting was called for yesterday, 6th inst.

Great Northern and City Railway Co.

THE half-yearly general meeting of the shareholders of the above company was held on 29th ult. at the Westminster Palace Hotel, the Earl of Lauderdale presiding.

The CHAIRMAN, in proposing the adoption of the report, said they would see by the accounts a falling-off in the traffic. Consequently their working expenses which, at the corresponding half-year of last year, were 51·50 per cent., had been for the last half-year 54·11 per cent., though actually in money only £155 up. They had this year to contend with the competition of motor-buses and tramcars, which accounted for there being no set-off against the decrease by the usual normal increase of travellers. A working loss of £5,086 appeared as the result. That sum, however, had again been provided, as in past years, from outside sources. He would mention what perhaps was an open secret, that the chief friends of the company, who had provided over £28,000 for those recurring deficiencies by means of free gifts to the company out of their own pockets, had been Messrs. S. Pearson & Son, Ltd., who constructed the railway, and who were large shareholders and creditors of the company. Had it not been for that timely and continuous support, the concern would, he thought, have soon passed into the hands of a receiver. A fresh issue of preference stock to the amount of £85,000 had been made to Messrs. Pearson, which, as they were all, no doubt, aware, had been due to them for some years past. They would also see that whilst Lloyd's bonds had increased by £40,000, the loan due to the contractors had been reduced by a like amount. The cross-action between the Regent's Canal Co. and the railway, in reference to the water supply, had been settled on fair and satisfactory terms, and the railway company would, in future, obtain its feed water from other sources than the canal, and would also make a reduced payment to the canal company in respect of water supplied by the latter for other purposes. They must all be conscious of the fact that the history of the company had been one of continuous disappointment ; and if it had not been for the fact that the directors entered into a competitive struggle with other lines, the company would quickly have succumbed. As it was, they had carried on for nine years a struggling existence, and one made more difficult year by year, owing to the unexpected arrival of the motor-bus and the electrification of the tramways, &c. That had all tended to make it extremely difficult for that little disconnected railway to hold its own. Some time ago the directors thought it advisable to link up the line with a main-line system, so that the value of its large tunnels might be utilised, and various negotiations took place, but until a few months ago without success, when the matter was taken up by the Metropolitan Co. The latter company now had a Bill before Parliament which provided for the revival of the extension of the railway to the Bank, which that company only allowed to lapse through sheer inability to show any prospects of being able to finance it. In addition it was proposed to extend the railway to a junction with the Waterloo and City Railway, so that it would be possible to journey under cover all the way from the South-Western stations to the North of London. Other extensions were also proposed which, in short, meant that the Metropolitan Railway proposed to take over their line and develop it as it required to be developed. They had to congratulate themselves upon the fact that a total loss of their capital was not to be their fate. So far as the debenture-holders were concerned, they would receive £ for £ an equal amount of Metropolitan 3½ per cent. "A" debenture stock, and the "A" shareholders were receiving 75 per cent. of the face value of their shares in Metropolitan ordinary stock, with dividends slightly restricted. The "B" deferred ordinary shares would get 50 per cent. of the face value. As it was, their line was earning nothing for its shareholders, and by itself had no prospect of earning a dividend ; as part of a large and energetic railway, however, it promised to become a profitable feeder, and with its success their prospects would also be improved. It was true they would have to submit to a reduction of ½ per cent. of their interest, but, on the other hand, they would secure an easily saleable stock of unquestionable security. Out of all the debenture-holders 87½ per cent. had sent in consents to the scheme. Some comment had been made on the fact that whilst the preferred, ordinary, or "A" shares, got 75 per cent., the "B" shares received only 50 per cent. in stock. It was only right to explain that both the preferred and deferred were ordinary stock, and as a matter of strictness on a division, each share, whether "A" or "B," was entitled to receive the same amount of stock. Inasmuch as the arrangement with the Metropolitan Co. had got to be carried through by agreement, and each class of share was dependent on the vote of the other to secure the acceptance of the agreement, it had been thought right that the "A" shareholders, who were entitled to a preferential dividend, should, as some compensation, get a larger amount of stock, and so the "A's" got 75 per cent., and the "B's" only 50 per cent. A special meeting of the "B" shareholders would be held later on, when they would be asked to waive their strict rights to an equal distribution and to agree to the acceptance of the smaller proportion. As regarded the directors, he (the chairman) and his colleague, Sir Clarendon Hyde, would join the board of the Metropolitan, and the other directors would resign. He thought that whilst recognising that the Metropolitan Railway had made a fair bargain in the matter, it had, at the same time, saved them all from a very unsatisfactory position. Not one proxy had as yet been sent in against the scheme. He proposed that the report and accounts be adopted.

MR. CHARLES STEEL (deputy chairman) seconded, and the motion was carried.

After the auditors, &c., had been re-elected, the SOLICITOR to the company explained briefly the object of the amalgamation, and the proceedings closed.

Mersey Railway Co.

THE directors' report for the half-year ended December 31st, 1912, states that the train mileage run during the half-year was 276,73[illegible] miles as compared with 301,685 during the corresponding six months of 1911. The number of passengers conveyed during the half-year was 6,622,084, as against 5,914,743 for the corresponding period of 1911, exclusive of season ticket holders. The total receipts from all sources for the half-year were £59,651, as compared with £54,150. The working expenses, exclusive of the charges for pumping, ventilation, and lifts were £27,427, equal to 45·97 per cent., as against £27,065, equal to 49·98 per cent. These charges for pumping, ventilation, and hydraulic lifts, for the past half-year amounted to £3,818, equal to 6·40 per cent., as compared with £3,125, or at the rate of 5·77 per cent. Under the scheme of agreement scheduled to the Mersey Railway, 1900, as extended by the Mersey Railway Acts, 1906 and 1910, the payment of interest on the following debenture stocks, viz. :—1866, 1871, 1882/3/5 and B, was contingent on the revenue of the company available therefor in each separate year. The auditors had certified that the revenue available for this purpose for the year ending December 31st, 1912, amount to £18,061, which was accordingly being distributed to the debenture-holders as follows :—Interest at 4 per cent. on the 1866 debenture stock, £4,664 ; interest at 3 per cent. on the 1871 debenture stock, £3,000 ; interest at £2 17s. 9d. per cent. on the 1882/3/5 debenture stock, £10,395 ; balance carried forward, £1 12s. 7d. The interest on these debenture stocks was duly paid to the debenture-holders on February 1st, 1913. The meeting is to be held in London on February 11th.

South London Electric Supply Corporation, Ltd.—The directors recommend, subject to final audit, a dividend on the ordinary shares for the year 1912 at the rate of 5½ per cent. per annum, as compared with a 5 per cent. for the previous year.

Metropolitan Electric Tramways, Ltd.—An extraordinary general meeting will be held at Electrical Federation Offices, W.C., to-day, Friday, to consider a resolution approving the Bill intituled, "A Bill to empower the Metropolitan Electric Tramways, Ltd., to provide and work vehicles by means of railless traction ; and for other purposes."

City and South London Railway Co.

THE report of the directors shows that the receipts from all sources for the half-year ended December, 1912, amounted to £83,877, and the cost of working was £42,941, leaving a profit of £40,936. Inclusive of the balance brought forward, the net revenue account shows an aggregate total of £43,130. After making provision for the debenture stock interest, rent charge, and the transfer to the renewal fund of £1,500, a balance remains available for dividend of £27,538. Out of this the directors recommend that the full dividend of 5 per cent. per annum be paid on the preference stocks, 1891, 1896, 1901 and 1903, and that a dividend at the rate of ½ per cent. per annum be paid upon the consolidated ordinary stock for the half-year, leaving £2,588 to be carried forward to the next account, as against 1½ per cent. per annum and £2,815 carried forward last year.

Half-year.	Passengers, inclusive of season tickets.	Receipts, including season tickets.	Dividend per cent. per annum.
June 30th, 1910	12,857,324	£83,413	1½
December 31st, 1910 ..	12,800,719	£86,103	1½
June 30th, 1911	13,318,622	£87,591	1½
December 31st, 1911 ..	13,840,339	£85,317	1½
June 30th, 1912	12,510,728	£81,656	1½
December 31st, 1912 ..	12,018,874	£78,839	½

The decrease in traffic receipts was spread very generally throughout the line, and about one-fourth of the whole amount was in bookings with other companies. The directors attribute it mainly to the extensive and general development of motor-omnibuses, which, by direct competition and by intersecting routes, have diverted much of the traffic which formerly came to this system. The directors, foreseeing that the reduction in the receipts had not reached its limit, decided that the interests of all classes of stockholders would be best served by arriving at an arrangement with a larger company, and after anxious consideration and some delays, a scheme was negotiated with the Underground Electric Railways Co. of London, Ltd. The full details of this arrangement were submitted to the ordinary stockholders. Approximately 99 per cent. of the consolidated ordinary stock of the company has, in pursuance of this scheme, been transferred to the Underground Electric Railways Co. of London, Ltd. The directors who have resigned in accordance with the terms of the scheme are Messrs. J. F. S. Gooday, S. Barclay Heward and E. Tate, and in their places have been appointed Mr. A. H. Stanley (managing director), Mr. T. C. Jenkin, and Admiral Sir Cyprian A. G. Bridge, G.C.B. In intimating these resignations, the chairman desires to place on record his regret at parting with colleagues much esteemed on personal grounds, whose counsel and co-operation had been at all times of the greatest value to the company. The appointment of Mr. Jenkin to a seat on the board involved, and was preceded by, his resignation of the office of general manager. This office he had held since May, 1890, and had displayed therein a degree of vigilance, courtesy, and organising capacity which it would be difficult to overpraise. It is satisfactory to be able to announce that in his new capacity Mr. Jenkin's devotion and experience will still be at the service of the company. The company are promoting a Bill in the ensuing session for enlarging the tunnels, for raising the necessary capital for this work, for new rolling stock and electrical equipment, and for other purposes, which will be submitted to the proprietors at a special meeting to be held at the conclusion of the ordinary general meeting. The London Electric Railway Co. are promoting a Bill, which will also be submitted to the special meeting, to authorise a physical junction near Euston, between this company's line and the Charing Cross, Euston and Hampstead Tube. This junction will enable up-to-date trains to run from Edgware, Golder's Green, Highgate, &c., through this company's enlarged tunnels to Euston, King's Cross, the City, London Bridge, and Clapham Common.

The meeting is to be held on February 11th.

London Electric Railway Co.

THE ordinary general meeting of the shareholders was held on Friday last at the Westminster Palace Hotel, London, Lord George Hamilton presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 168), said that the capital powers of the company had been increased by £700,000 additional capital, and £200,000 additional borrowing powers authorised by the London Electric Railway Act, 1912, and by £600,000 additional capital and £200,000 additional borrowing powers authorised by the Edgware and Hampstead Railway Acts, 1902 and 1912. The amount of preference stock created had been increased by £23,670 for which an equivalent amount of ordinary shares of the Edgware and Hampstead Railway Co. was received in accordance with the terms of the London Electric Railway Act, 1912. During the half-year £235,056 of debenture stock was issued, the proceeds of which were being used for paying the cost of the Golder's Green, Paddington and Charing Cross extensions. The amount spent on capital account was £279,322, of which £159,251 was expended on the extension from Golder's Green, £39,830 on the Paddington extension, £35,223 on the Charing Cross extension, and £14,518 on Earl's Court escalator. The gross receipts had amounted to £376,710, being an increase of £10,520 for the corresponding period of the preceding year. There had been an increase in expenditure of about £8,300 compared with the corresponding period, of which £4,000 was increase in cost of train working, due principally to the increased cost of coal, and there was every indication that the price of coal would continue to be high during the current year. The car-mileage showed an increase of 351,210, or 3·85 per cent., while the passenger receipts per car-mile were 8·87d., compared with 9·01d. for the corresponding period. The percentage of operating expense to gross earnings was 43·19 per cent., compared with 42·12 per cent. for the corresponding period. There were two Bills referred to in the report, one by their company and the other by the City and South London Railway Co. The powers sought in the company's Bill were to enable them to construct a physical connection between the City and South London and their Hampstead and Highgate railway at Euston, so as to allow of a through service of trains into the City. In order that this might be done, it was necessary for the City and South London Co. to enlarge its tunnel, which was of a smaller diameter than their company's, and that company was promoting a Bill seeking powers for that purpose. The work on the Paddington and Charing Cross extensions involved many complicated engineering problems, but it was progressing satisfactorily, and it was hoped that both those extensions would be opened for traffic either in the late summer or the early autumn of the present year. The contract had also been made for the installation of escalators at Oxford Circus Station, and this work had commenced. This was the last occasion upon which he would act as chairman. He was sorry to leave the company; his relations with all concerned had been most pleasant and harmonious. He was especially sorry to leave it at a time when it was embarking into a larger system of co-operation with other companies and in extensions of its own. The Underground Co. had been forced, not by any desire to create a monopoly, but by the pressure of the circumstances with which it had had to deal, to extend its operations and to enter into arrangements with other enterprises similarly engaged. The huge and ever-growing daily passenger traffic throughout London could not otherwise be handled, if the convenience of the traveller had to be consulted and proper facilities afforded for the increasing number of persons requiring daily, constant, continuous, and rapid transport to and from all parts of the metropolis and its suburbs. This class of traffic could not have its necessities adequately met if London was arbitrarily divided into artificial and self-contained sections. The Underground was, therefore, forced to become a very large concern, and that being so, it was desirable to so adjust and shape every part of the co-operation thus necessitated so as to ensure smooth and harmonious working throughout. In the opinion of those whose judgment he trusted, it was thought that he might be more usefully engaged elsewhere. He bowed to that decision and took leave of them all with regret. He was consoled by knowing that his successor, Lord Farrer, was a director of exceptional experience in railway management. He came from a family distinguished in many walks of life, and he had no doubt that these railways would prosper under his direction. His experience as chairman, and the constant examination and revision of the figures brought weekly under his notice, had made it clear that it was only by a closer interchange and linking up with existing systems that an adequate return could be secured upon the great outlay of those underground undertakings. During the last two years, excluding the exceptional period of the Coronation festivities, the growth of traffic receipts was almost entirely derived from terminal and exchange stations. The intermediate stations held their own, but no more. For short distances, especially in fine weather, the motor-'buses were their most formidable competitors. They had in hand a number of extensions and improvements which could not fail to largely augment their present traffic. The Paddington extension would bring them into direct physical connection with the Great Western system, whilst the further extension from Paddington to Queen's Park would enable them to co-operate with the London and North-Western Railway in bringing passengers from their lines straight through to lines operating on the south of the Thames. The Golder's Green extension would run through a rapidly-increasing residential neighbourhood, a large proportion of whom were daily conveyed to and from the Metropolis. Under the Bills promoted this session by the City and South London Railway Co., their railway would be so connected with their lines as to become an integral part of their system. The Charing Cross improvements which were approaching completion would, when finished, provide a consolidated station which would afford full facilities for a thorough exchange of passengers between the Bakerloo, the Hampstead, and the District Railways. Those and other developments had not been promoted piece-meal or at haphazard, but they were part of a general policy carefully thought out, by which they hoped out of the isolated and scattered lines they originally started, to establish a compact and ubiquitous system of underground travel through the Metropolis. He should watch with interest and attention the development and realisation of this great utilitarian idea.

SIR ALGERNON WEST, G.C.B., seconded the motion, and the report was adopted.

Underground Electric Railways Co. of London, Ltd.—The directors have declared a dividend at the rate of 6 per cent. per annum on the income debentures, and at the rate of 6 per cent. per annum on the income bonds.

London General Omnibus Co., Ltd.—The directors recommend, subject to audit, the payment of a dividend on the ordinary shares of the company for the period ended December 31st, 1912, of 8 per cent., free of income-tax.

South London Electric Supply Corporation, Ltd.—The directors recommend, subject to final audit, a dividend on the ordinary shares for the year 1912 at the rate of 5½ per cent. per annum. This compares with a 5 per cent. dividend for the previous year.

Liverpool Overhead Railway Co.

THE directors' report shows that the gross revenue receipts for the half-year ended December, 1912, amounted to £43,985, and the working expenses to £28,869.

The number of passengers carried during the last two years is as follows :—

	Half-year June, 1911.	Half-year Dec., 1911.	Half-year June, 1912.	Half-year Dec., 1912.
First class	579,338	617,097	628,352	674,460
Third class (incldg trmys)	3,113,073	3,398,069	3,323,291	3,648 008
Workmen (spec. ret. tckts)	1,701,196	1,723,340	1,919,696	1,975,078
Total	5,393,597	5,738,506	5,871,339	6,297,546

In consequence of ill-health, Sir W. B. Forwood has resigned his position as chairman of the company. He will retain his seat on the board, and, it is hoped, will, ere long, be able to take his usual keen interest in the working of the railway The meeting of shareholders will, in future, be held only once in each year, in the month of February. The directors intend, when possible, to declare and pay interim dividends in the month of August, as heretofore. The receipts from passenger traffic amounted to £42,566 ; miscellaneous receipts and interest, £1,419 = £43,985 ; less working expenses and transfer to renewal fund, £28,869 = £15,116 ; less interest on mortgage debentures, and on calls paid in advance, £4,329 ; also less provision towards cost of adjustment of loan capital, £500, and written off for depreciation of investments, £300 ; leaving £9,986, plus £4,852 brought forward. This leaves available for dividend £14,839, out of which the directors recommend dividends at the rates of 5 per cent. per annum on the preference shares, and 2½ per cent. per annum on the ordinary shares, leaving £4,913 to be carried forward.

Metropolitan Railway Co.

THE half-yearly meeting was held on Wednesday, January 28th, at the Great Eastern Hotel, E.C., Lord Aberconway presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 189), said that on the expenditure side of the revenue account there was a saving in expenses of £1,239. Locomotive and generating expenses showed an increase of £1,751. Like all other railway companies, they were suffering from a serious increase in the price of fuel and also from an increase in the price of materials generally, and but for these circumstances, they would have shown a very considerable saving on this account, because their new generating machines at Neasden were enabling them to produce the current they required at a much smaller consumption of coal than under the old conditions. During the half-year they had burnt in the power house 31,089 tons of coal, as against 37,341 tons in the corresponding period, the decrease being 6,252 tons, or 17 per cent., while the output of current had been practically the same. On the receipts side of the account the disappointing feature was the first item, which showed that the receipts from the conveyance of passengers, apart from season ticket holders, showed a decrease of £1,444. The longer distance and the season ticket traffic both showed substantial advances, the falling off having been in the short-journey traffic, where they had a very severe competitor in the motor-'bus. Their losses on the working of the Hammersmith and City Railway and on the East London Railway were both less than in the corresponding period, and their proportion of the profit from the working of the City lines and of their joint lines with the Great Central Co. north of Harrow showed a substantial increase. The net result was that they had available for dividend £171,778, as against £164,677. That would enable them to pay the dividend on the whole of the preference stocks as usual, and to pay at the rate of £1 15s. per cent. per annum on the ordinary stock, carrying forward £9,496. Put shortly, the effect of the accounts was that they paid the same dividend as 12 months ago on the ordinary stock, notwithstanding that the amount of that stock had been increased by £729,000 ; they put £7,500 to their electrical renewal and depreciation fund, as against £5,000 in the corresponding period ; and they were carrying forward £280 more than on the previous occasion. Having referred to the progress being made with various alterations and widenings, the chairman said that at Neasden the whole of the five new sets of machines had been installed, though they were not all yet out of the contractors' hands. From their experience of them up to now, he might say that they were quite satisfied that they would effect all the economy in working that they intended they should do. They were putting up some additional sheds at Neasden for the housing of their rolling stock, and they hoped thereby to reduce their maintenance costs, as a great part of the stock had at present to remain in the open at night. They were laying an additional high-tension cable between Neasden and Moorgate Street to meet the increased call for current necessitated by the increased train services which they were now running, and which they had in prospect. In view of this they had placed an order with the Metropolitan Carriage, Wagon and Finance Co. for the building of 36 new cars which they required for working the electrified East London Line, the Hammersmith and Richmond Line, and for other purposes. The proprietors would be aware that in November last they issued an official statement through the Press in reference to the relations of the company with the Underground Co., which was a virtual amalgamation of most of the tube lines, the District Co., and the London General Omnibus Co. He had referred to this question at one or two previous half-yearly meetings, and they thought it right, in view of certain unauthorised statements having appeared in the newspapers on the subject, to issue an authentic announcement. He would like to state frankly and fully the reasons that led the board to the decision that it was not in the interests of the company that there should be a financial fusion between the Metropolitan and the Underground group. In the first place, he must remind them that the very serious and increasing competition of the motor-omnibuses with the whole of the underground lines in London was the main factor in determining those who had control of the majority of the tube lines to acquire the control of the Omnibus Co., and that they acted wisely in doing so there could be no question whatever. The motor-'bus had introduced a new and formidable element in competition. The old horse 'bus competed with the underground lines to a certain extent in the old steam days, but it could not compete effectively after these lines were electrified. The motor-'bus, on the other hand, could compete with them in the matter of speed for short distances, and the very great convenience it offered to the public in picking up people and setting them down at any point they desired, rendered it a very formidable competitor. Under these circumstances, and as the tube lines were dependent for practically the whole of their earnings on traffic for which the motor-'buses were competing, a common control of the two interests was undoubtedly desirable from every point of view. The Metropolitan Co.'s position, on the other hand, was quite different. Less than one-half of their total revenue was derived from traffic for which they were in competition with the motor-'buses, the main part of their receipts being from their longer distance traffic, from their goods traffic, and from their exchange with various trunk lines, where, for obvious reasons, they need not fear competition from the source he had named. That they had suffered and were still suffering seriously from the diversion of traffic to the motor-'buses within the London area was undoubtedly a fact, and though they were doing, and would continue to do, everything that lay in their power to attract short-distance traffic to the line by affording every possible facility, he had no hesitation in saying that they must not expect any growth in that section of the business. On the other hand, their longer distance traffic was capable of large expansion, and their policy during recent years had been to encourage and develop the traffic in their outlying districts. The board gave very careful, and indeed anxious, consideration to the whole matter before deciding to discontinue the negotiations with the Underground Co., and he hoped he had said sufficient to satisfy them that the possible sacrifice of future prospects that would have been involved in an amalgamation with the group in question would have been greater than the circumstances justified. He considered it would have been a mistake to have exchanged the prospects that they undoubtedly had for such immediate benefits as might have come to them by throwing in their lot with the underground group. Their discussions with the Underground Co. were carried on throughout in a most friendly spirit, there being an earnest desire on both sides to make the best arrangement possible for the respective undertakings. It was finally recognised on both sides that it was practically impossible to devise a scheme that would be mutually satisfactory, and it was thought that, so far as the working of the undertakings was concerned the objects in view could be accomplished without a financial union. As regarded the East London line, where they were joint lessees with several other companies, the work of electrification was approaching completion, and they expected the line would be ready for electrical operation in the course of about two months. They would then resume the running of through trains between New Cross and their system, which was previously a source of considerable profit to them.

MR. PAUL SPEAK seconded the motion.

MR. POWNALL, in a lengthy speech, criticised adversely the proposal of the directors to purchase the Great Northern and City Railway Co. That company was, he said, an unsuccessful and bankrupt concern. Having given the figures of the actual results shown by the line, as compared with the estimates in the prospectus and pointed out that only on two occasions had the company earned sufficient to pay the interest on the debenture stock, Mr. Pownall gave it as his firm opinion that the future prospects were not more encouraging. They were, he said, told that if they did not buy the line the Great Northern Railway Co. would do so, and if that was so, he would rather that company bought it than the Metropolitan.

The CHAIRMAN said that in the opinion of the board they had the opportunity of purchasing the Great Northern and City Co. on very favourable terms, and they were satisfied that if it came into their hands, and they extended it as they proposed, it would put the earning value of the line upon a footing that it had never yet occupied by reason of its short length. He reminded the shareholders that the Metropolitan Co. had a power station at Neasden capable of turning out a very much larger quantity of electrical power than they could now consume, and it was proposed to use this surplus energy to run the new line, and to use the station of the Great Northern Co. for other purposes.

After a long discussion, the report was eventually adopted.

A Wharncliffe meeting was subsequently held, at which the CHAIRMAN proposed a resolution approving the Bill providing for the purchase of the Great Northern and City Railway. In the course of a long speech defending the proposal, he explained the various extensions which they proposed to make, and said it was their intention to take over the line as and from July 1st next.

Considerable discussion ensued, in which various shareholders urged the desirability of delay in order to give further time to consider the matter, and in the end it was decided to adjourn the consideration of the question to a special meeting, to be held on February 12th. In the meantime it is proposed that a number of the largest shareholders shall confer with the board on the matter.

Smithfield Markets Electric Supply Co., Ltd.

The directors' report for the year 1912 shows that the gross profit amounted to £4,005, compared with £3,869 last year, and the net profit to £1,525, compared with £1,383. A further sum of £400 has been placed to the debenture stock redemption fund, making a total of £1,282 at the credit of this account, and £500 to depreciation and general reserve fund accounts. The available balance, including £629 brought in from 1911, is £2,154, which the directors propose to deal with by paying a dividend at the rate of 2 per cent. per annum on the ordinary shares (£1,200), and carrying forward £954. The output of current for lighting has been maintained, but the demand for power has been rather less, probably due to the abnormal conditions prevailing during the summer months. The plant and machinery have been efficiently maintained and a reduction in generating costs per unit effected. The installation of the new generating plant is proceeding satisfactorily and will be completed very shortly. The vacancy, caused by the death of Sir J. H. Morris, K.C.S.I., one of the trustees for the debenture-holders, has been filled by the appointment of Sir Herbert Leon, Bart., as a trustee.

The annual meeting takes place to-day (Friday).

STOCKS AND SHARES.

Tuesday Evening.

Markets in the Stock Exchange have called something of a halt pending the war developments in the Balkans. Opposed to the idea which existed, even up to Monday night, that the two combatants would not come to blows after all, was the hope that they would fight out their differences once and for all, and so settle the matter. For a great deal too many years the Near Eastern Question has been a constant thorn in the side of the Stock Exchange; and its extraction, even if a painful process during the operation, would be welcomed by financial circles the world over. Business, meantime, is very quiet, and the liveliest feature this week amongst electrical sections have been the movements in Marconi shares.

The Home Railway market was greatly cheered by the declaration of unexpectedly good dividends by some of the Northern lines. Prices of steam stocks improved generally, and this had a good effect upon Metropolitans and Districts, the quotations of which improved. Metropolitans, allowing for deduction of the dividend of 17s. 6d. per cent., are 1⅛ up; while Districts have recovered 1. The eagerly-expected report of the Underground Electric Railways Company showed that the earnings were sufficient to pay the full 6 per cent. on the Income Bonds, but the carry forward did not come up to hopes which had been expressed about it previously, and was not large enough to justify some of the extravagant talk recently heard in connection with the company's Ordinary shares. The price of the latter, therefore, eased off ⅛ to regain it later, while the 1s. shares fell $\frac{1}{16}$, and the Income Bonds themselves at 95½ showed a fall of ½. Confidence in all these issues, however, remains strong; and unless holders come in to realise their shares more eagerly than they have done so far during the past week, there might be a recovery, provided the meeting is a satisfactory one.

Central London Ordinary and Deferred both shed a point; but the Preferred is 1 up, in consequence of the good return which the stock shows at the present price, included in which, of course, is the recently-declared dividend of £2 per cent. Great Northern and City Preferred fell 10s. to 2⅛ on the opposition manifested at the meeting of the Metropolitan Railway shareholders to the scheme for the absorption of the Tube line by the Metropolitan. When the project was first announced, the wonder was expressed here why the older railway should want to acquire the Great Northern and City, and evidently some of the Metropolitan proprietors are still unsatisfied on the point.

British Electric Traction 6 per cent. Preferred stock has receded to 11½, but Potteries Preference are better, and there is a vague notion that the Company's Ordinary shares may be worth picking up as a gamble that ought to be kept. In view of the very small market that there is in the shares, it would seem to require some courage to buy these, even for the purpose of putting away.

Dividend announcements have already begun to appear from the English electricity supply Companies. The Westminster Company announces a distribution at the rate of 11 per cent. per annum, making the regular 10 per cent. for the year; while the St. James's Company is paying 5s., also as usual, making a similar percentage.

The list of prices has been rectified to some extent, and brought more into line with the actual conditions of supply and demand in the market. Chelseas, London Preference, Metropolitan Ordinary, and County Ordinary and Preference have been marked up ½ in each case. Westminsters and St. James's have both declined, in spite of their dividend declarations. The principal change is a rise of 15s. in City of London Ordinary, the market being strengthened by recurrence of the demand from the same group whose operations started the previous rapid improvement. The market is none too supplied with shares of any of the best London Electricity Supply Companies, but there is not a great deal of inquiry to stimulate prices, and the National Telephone Arbitration award is not yet far enough away to remove a certain feeling of doubt as to how the electric undertakings will be treated in 1931.

Remark was made here in our last report upon the way in which the manufacturing shares were being picked up by people who knew how busy quite a number of the companies are at present. This movement has gone further. Electric Constructions have followed up their advance of a week ago by a gain of $\frac{3}{16}$. British Aluminium Ordinary and Preference have both improved, and the Prior Lien Debentures gained 1, a similar advance being secured by British Thomson-Houston Debenture. Castner-Kellner Debenture stock recovered 1¼ of its dividend deduction, while Edison & Swan 4 per cent. Debenture stock rallied a point after its drop of last week, although the Ordinary shares (partly paid) have been marked down to the lugubrious figures of nothing to ¼. No doubt the readers of these Stock Exchange notes are better conversant with the amount of work which manufacturing companies have in hand, than a mere financial writer can expect to be, since he is but the wax upon which are stamped the impressions of those more fully informed. Babcock & Wilcox rose $\frac{1}{16}$ to $3\frac{7}{16}$, but in Willans and Robinson there are no changes.

The Marconi market, as noted above, is one of the most active in the Miscellaneous section. The price of the shares has spurted strongly, touching 4⅞ on Monday, and finishing on Tuesday night at 4⅝, leaving a rise of $\frac{3}{16}$ on the week. The cross-examination of Mr. W. R. Lawson, one of the journalistic critics of the Marconi agreement, is followed with particular interest in the Stock Exchange, because Mr. Lawson is a member of the House. With the parent shares, the prices of Canadian, American and Spanish Marconis have advanced in sympathy. The market is a very difficult one to read, and it is largely at the mercy of a comparatively small clique, whose extensive deals bring about these violent fluctuations.

National Telephone Deferred has quieted down again, and the price shows a fair recovery after its very steep fall. So many conflicting calculations are being made even yet as to the price at which the stock will be paid off that no good purpose can be served by reproducing these guesses. American Telephone Capital stock fell 1½ for the same reason as mentioned on a previous occasion, namely, that it is feared the United States Courts may declare the Company to be an illegal combination in restraint of trade. The same contention applies—more indirectly, of course—to the Anglo-American Telegraph Company, now under the wing of the Western Union Company. But the prices of the Anglo group are unaffected, because it is taken for granted that, even in the event of the so-called trust being dissolved, the Anglo could keep up its own end perfectly well. Mackay Common shares fell 2. Cuba Telegraphs are a good spot, with a 10s. rally; but West India and Panamas continue to sag, and the price has lost another $\frac{1}{16}$. The Eastern group keeps very steady, and there is not a change worth mentioning beyond a point decline in Eastern Ordinary stock.

The unpleasant flavour left in the mouth by the Georgia Light and Power incident continues to militate against this department. Georgias themselves have recovered to 44½, and the Mexican group is a little better. Brazil Tractions recovered the 1½ per cent. deducted for dividend, and another ½ in addition; while British Columbia Electric stocks are just steady, the Deferred losing a point, which the Preferred picked up. Rio First Mortgage Bonds are better. Barcelona Trams rose from 47 to 50, and reacted to 49. United Electric Tramways of Monte Video shares are a shade easier, but there is not much doing in them, and the prices of the pre-ordinary issues remain very firm. Mexico Trams are harder, and in the Mexican Light and Power group the only alteration is a partial recovery of the coupon on the company's 5 per cent. First Mortgage Bonds.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.).	Receipts for the month.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Bath	Jan. 29	2,714	+ 105	5	3,569	+ 205	..	..
Blackpool-Fleetw'd	Feb. 1	955	+ 1	4	1,176	— 69	8	..
Bristol	Jan. 31	27,302	+3,810	4	30,511	+ 2,967	30·5	..
‡Brit. Elec. Trac. Co.	„ 24	91,496	+5,332	3½	78,748	+ 5,145	..	..
Chatham and Dist.	„ 30	3,345	+ 325	4	3,600	+ 103	14·98	..
Cork	„ 30	1,742	+ 31	4	1,876	— 97	9·89	..
Dublin	„ 31	22,061	+1,724	4	24,687	+ 903	54·25	..
Hastings	„ 30	2,831	+ 66	..	..	..	19·3	..
Lancashire United	„ 29	5,053	+ 393	4	5,463	+ 304	39	..
Llandudno-Col. Bay	„ 24	598	+ 52	8	1,175	+ 88	6·5	..
London United	Feb. 1	21,182	+ 401	5	27,151	+ 705	..	..
Tyneside	Jan. 29	1,624	..	5	1,709	— 126	11	..
Anglo-Argentine	Jan. 28	219,170	+18,696	4	219,170	+18,696	..	..
Auckland	Dec. 20	20,556	+2,528	25	1·7,759	+18,280	24·11	·8
Bombay (B.E.T.)	Jan. 3	12,668	— 631	f2½	160,998	+ 3,2·7	..	..
Brisbane	Dec.	25,890	+1,660	52	254,·11	+ 2,211	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Feb. 1	17,655	+1,167	..	..	..	..	..
Cape Electric T. Ld.	..	..	..	..	..	..	..	..
Kalgoorlie, W.A.	Dec.	3,206	..	52	57,810	..	20·5	..
Lisbon	..	..	..	..	..	..	..	..
Madras	Jan. 31	3,541	+ 333	4	3,541	+ 333	14·7	2
Montevideo	Jan.	38,561	+2,010	13	102,167	+11,355	..	..
Cen. London Rly.	Feb. 1	27,465	+1,683	5	28,080	+ 2,239	6·78	·4
City & S. Lon. Rly.	Jan. 25	12,491	—1,305	4	12,491	— 1,305	7·26	..
Dublin-Lucan Rly.	„ 31	455	+ 20	5	505	— 8	7	..
G.N. and City Rly.	Feb. 1	6,·75	— 751	5	7,929	— 953	3·5	..
L'pool Overh'd Rly.	Jan. 26	6,544	+ 575	4	6,544	+ 575	6·6	..
London Elec. Ry. Co.	Feb. 1	60,430	— 180	5	75,240	— 805	21·25	..
Mersey Railway	„ 1	8,991	+ 501	5	11,319	+ 658	4·5	..
Metropolitan Rly.	Jan. 26	67,408	—1,043	4	67,408	— 1,043	25·75	..
Met. District Rly.	Feb. 1	53,683	+2,732	5	6·,913	+ 3,345	25	..

* Compared with the corresponding period of 1912.

‡ Includes horse, steam and other receipts.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Feb. 4th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	5½	5†	9⅜ — 10⅜	..	5 4 9
Do. 4½ % Pref.	10	4½	4½	8½ — 9½	..	4 12 4
Do. Second 6 % Pref. ..	10	6	6	10 — 10½	..	5 14 8
Do. 4½ % Deb. Stock	Stock	4½	4½	96 — 98	..	4 11 10
Brompton & Kensington, Ord...	5	10	9†	8⅜ — 9⅜	..	5 6 8
Do. 7 % Cum. Pref.	5	7	7	8½ — 9	..	3 17 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	95 — 98	..	4 1 8
Charing Cross, West End & City	5	5	5†	4⅜ — 5⅛	..	4 17 7
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	..	4 12 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4⅛	4⅛	3⅞ — 4⅛	..	5 2 10
Do. Do. 4 % Deb... ..	100	4	4	92 — 94	..	4 5 1
Chelsea, Ord.	5	5	4†	4⅜ — 5⅛	+ ⅛	4 15 3
Do. 4½ % Deb.	Stock	4½	4½	96 — 99	..	4 10 11
City of London, Ord.	10	8	6†	16⅜ — 18½	+ ½	4 7 8
Do. 6 % Cum. Pref.	10	6	6	12½ — 13½	..	4 9 0
Do. 5 % Deb.	Stock	5	5	116 —120	..	4 3 4
Do. 4½ % Second Deb. ..	100	4½	4½	100 —102	..	4 8 3
County of London, Ord... ..	10	6	4†	11⅛ — 12	+ ⅜	5 0 0
Do. 6 % Pref.	10	6	6	11⅜ — 12⅛	+ ⅜	4 19 9
Do. 4½ % Deb.	Stock	4½	4½	104 —106	..	4 4 11
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101	..	4 8 3
Edmundson's, Ord.	£3	Nil	..	5/— 10/	..	Nil
Do. 6 % Cum. Pref.	5	Nil	3	4½ — 4⅝	..	..
Do. 6% Non-Cum. Pref. ..	5	..	..	1⅜ — 1⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	82 — 85	..	5 5 11
Folkestone	5	6	6	4⅜ — 5½	..	5 17 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 5⅜	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	90 — 92	..	4 17 10
Hove	5	9	8†	7⅞ — 8	..	5 12 6
Kensington & Knightsbridge, Ord	5	9	8†	7⅞ — 8½	..	5 10 9
Do. 4 % Deb.	Stock	4	4	90 — 93 xd	..	4 6 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80 xd	..	5 12 6
London Electric, Ord.	8	2½	..	1½ — 2	..	3 15 0
Do. 6 % Pref.	5	6	6	5 — 5⅜	+ ⅛	5 11 7
Do. 4 % First Mort. Deb. ..	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	4	4†	3½ — 4	+ ⅛	5 0 0
Do. 4½ % Cum. Pref... ..	5	4½	4½	4⅛ — 4½	..	5 0 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	97 —100	..	4 10 0
Do. 3⅝ % Mort. Deb... ..	Stock	3⅝	3⅝	84 — 86	..	4 1 5
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	98 —101	..	4 9 1
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4⅝ — 4⅞	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99½ —102½	..	4 17
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9⅜ — 10⅜	..	5 11
Oxford	5	7½	6†	6½ — 6⅝	..	5 9
St. James' and Pall Mall, Ord.	5	10	10†	9½ — 9⅝	— ½	5 2 7
Do. 7 % Pref.	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3⅜ % Deb.	100	3½	3½	84 — 87	..	4 0 6
Smithfield Markets, Ord. ..	5	2	..	1⅜ — 1⅞	..	..
South London, Ord.	4	5	..	2⅜ — 3½	..	6 3 1
Do. 5 % First Mort. Deb. ..	100	5	5	97 —100	..	5 0 0
South Metropolitan, 7 % Pref...	1	7	7	1⅛ — 1¼	— 1/32	5 12 0
Do. 4½ % First Deb. Stock ..	100	4½	4½	96 — 99	..	4 11 3
Urban, Ord...	£3	Nil	..	⅞ — 1	..	..
Do. 5 % Cum. Pref.	5	2	‡	2⅝ — 3⅛	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	85 — 88	..	5 2 0
Westminster, Ord.	5	10	9†	8⅞ — 9⅛	— ⅛	5 8 1
Do. 4½ % Cum. Pref... ..	5	4½	4½	4⅞ — 5⅛	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅞ — 5⅞	..	5 6 8
Calcutta, Ord.	6	8½	7†	6⅞ — 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	4 13/16 — 5 1/16	..	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	92 — 94	..	5 6 5
Canadian Gen. El. Com. ..	$100	7	7	116 —120	..	5 16 8
Do. 7 % Pref.	$100	7	7	120 —124	..	5 13 0
Cordoba Lt., Power and T., Ord.	1	8	5	1⅜ — 1⅝	..	5 6 8
Do. 5 % Deb.	100	5	5	98 — 99	..	5 1 0
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	93 — 95	..	6 6 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	90 — 93	..	5 7 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95⅜ — 97½	— ½	5 2 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/— 1/6	..	Nil
Do. 6 % Pref.	1	6	6	⅞ — 1	..	9 15 2
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	5	Nil	..	1⅜ — 1⅞	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	101 —104	..	4 16 2
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	84½ — 86½	..	5 15 7
Mexican Lt. & Power, Common	$100	4	4†	82 — 86	..	4 13 0
Do. 7 % Cum. Pref.	$100	7	7	105 —109	..	6 8 5
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95 — 97 xd	+1	5 3 1
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	87 — 89	..	5 12 0
Montreal, Lt., H. and Power ..	$100	8	9†	240 —245 xd	..	3 13 5
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	..	217 —227	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	106 —111	..	5 5 8
Do. 5 % Deb. Stock	Do.	5	5	100 —102	..	4 18 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital ..	$100	5	5	148 —152	..	3 5 9
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	106 —108	..	4 12 7
Do. 4½ % Per. Deb.	Stock	4½	4½	100½ —102½	..	4 7 10
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	98½ —100½	..	4 9 7
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Victoria Falls Power, Pref. ..	1	11¼d.	17½d.	3⅜ — 3½	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	104 —106	..	4 14 4

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4½†	7 — 7⅛	..	6 0 0
Do. 5 % Deb. Red.	Stock	5	5	97½ — 99½	..	5 0 6
American Telep. & Teleg., Cap.	$100	8	8†	134½ —136½	—1½	5 17 3
Do. Collat. Trust	$1000	4	4	91 — 93	..	4 6 0
Anglo-American Telegraph ..	Stock	8	8	65½ — 67½	..	4 8 11
Do. 6 % Pref.	Do.	6	6	110¾ —111¾	..	5 7 7
Do. Def.	Do.	80/-	..	24 1/16 — 24 1/8	+ 1/16	6 0 8
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	7	8	7½ — 7⅞	..	5 3 3
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	79 — 81	—1	4 18 9
Cuba Telegraph	10	6	6†	8½ — 9½	+ ½	6 9 9
Do. 10 % Pref.	10	10	10	16 — 17	..	5 17 8
Direct Spanish Telegraph, Ord.	5	4	4†	3½ — 3⅝	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6⅝ — 7	..	7 2 10
Direct United States Cable ..	10	5	4	6⅝ — 7⅜	..	6 15 7
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	182 —185	—1	5 3 8
Do. 3½ % Pref. Stock.. ..	Do.	3½	3½	78 — 80	..	4 7 6
Do. 4 % Mort. Deb.	Do.	4	4	96 — 98	..	4 1 8
Eastern Extension	10	7	7†	18 — 18½	..	5 3 8
Do. 4 % Deb.	Stock	4	4	95 — 97 xd	+1	4 2 6
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98 —101	..	3 19 8
Globe Telegraph and Trust ..	10	6	6†	10⅜ — 10⅞	..	5 10 4
Do. 6 % Pref.	10	6	6	12⅜ — 12⅞	..	4 18 2
Great Northern Telegraph ..	10	18	18	28½ — 30½	..	5 18 0
Indo-European Telegraph ..	25	18	5†	57 — 59	+ ½	5 10 2
Mackay Companies Common ..	$100	5	5	85 — 89	—2	5 12 4
Do. 4 % Cum. Pref.	$100	4	4	68 — 72	+ ½	5 11 1
Marconi's Wireless Telegraph	1	20	..	4⅛ — 4⅜	+ 1/16	4 4 2
Do. 7 % Cum. Partic. Pref.	1	17	..	3⅞ — 4	+ ⅛	4 5 0
Monte Video Telephone, Ord. ..	1	6	6†	1⅜ — 1 7/16	..	5 13 0
Do. 5 % Pref.	1	5	5	⅞ — 1	..	5 14 8
National Telephone Def. ..	Stock	6	..	95½ — 97⅛	+1½	..
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	98¾ — 99¾	+ ⅛	4 10 8
Oriental Telep. and Elec. ..	1	8	6†	13¼ — 13⅝	..	4 9 10
Do. 6 % Cum. Pref.	1	6	6	1 5/16 — 1 3/8	..	4 18 6
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	+ ½	4 8 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	97½ — 99½	..	4 0 5
Reuter's	10	10	10†	11¼ — 11⅝	..	8 10 2
Submarine Cables Trust ..	Cert.	6	6	127 —130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	97 — 99	..	4 10 11
United River Plate Telephone	5	8	..	7 7/16 — 7 11/16	..	5 4 1
Do. 5 % Cum. Pref.	5	5	5	5⅜ — 5⅝	..	4 8 11
West Coast of America	2½	2½	..	1 5/16 — 1 7/16	..	4 0 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	95 — 98	..	4 1 8
West India and Panama Teleg.	10	2½	1½†	3 5/8 — 3 3/4	— 1/16	..
Do. 6 % Cum. 1st Pref. ..	10	6	6	10 — 10½	..	5 14 3
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9½ — 10	..	6 0 0
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd. ..	10	7	7†	13⅛ — 13⅝	..	5 2 9
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	97½ —100½	..	4 10 0

*Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. ‡ 3s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Feb. 4th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil		..	Nil
Do. 5 % Pref.	1	5	5		..	6 8 1
Do. 4½ % Deb.	100	4½	4½	76 — 81	..	5 11 1
Brit. Elec. Trac., 6 % Pref.	100	..	..	10½ — 12½	— ½	..
Do. Do. Deferred	100	..	..	5 — 7	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	87 — 90	..	6 13 4
Do. 7 % Non-Cum. Pr'f.	100	..	..	37 — 40	..	..
Do. 5 % Perp. Deb.	100	5	5	91 — 95	..	5 5 3
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 81	..	5 7 2
Central London Railway, Ord.	100	8	8†	81 — 83	—1	3 12 8
Do. Pref.	100	4	4	84 — 86	+1	4 13 0
Do. Def.	100	2	..	81 — 83	—1	2 8 2
Do. 4 % Deb.	100	4	4	98 —100	..	4 0 0
City & South London, Ord.	100	1⅛	1⅛†	37½ — 38½	..	3 11 5
Do. 5 % Pref., 1891	100	5	5	109 —111	..	4 10 1
Do. Do. 1896	100	5	5	109 —111	..	4 10 1
Do. Do. 1901	100	5	5	109 —111	..	4 10 1
Do. Do. 1903	100	5	5	109 —111	..	4 10 1
Do. 4 % Deb.	100	4	4	98 —100	..	4 0 0
Dublin United Trams, 6 % Pref.	10	6	6	12 — 13	..	4 12 4
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2 — 2¼	— ⅛	Nil
Hastings Trams, 6 % Pref.	1	6	6†	7/16 — 9/16	..	7 7 8
Do. 4½ % Deb.	100	4½	4½	69 — 74	..	6 1 7
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅝ — 2⅞	..	4 15 3
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb.	100	5	5	73 — 80	..	6 5 0
London Elec. Railw'ys, 4 % Deb.	100	4	4	95 — 97	..	4 2 6
London United Trams, 5 % Pref.	10	Nil	..	5 — 6	..	..
Do. 4 % Deb.	100	4	4	69 — 72	..	5 11 1

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Feb. 4th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Metropolitan Railway Consol.	100	1⅞	1⅞	58½ — 58¾xd	+1⅞	3 0 6
Do. Surplus Lands	100	2⅜	2⅜†	61 — 63 xd	+1⅜	4 6 0
Do. 3½ % Deb.	100	3½	3½	86 — 88	..	3 17 9
Do. 3½ % Pref.	100	3½	3½	84 — 86 xd	+ ⅜	4 1 5
Do. 3½ % Con. Pref.	100	3½	3½	83 — 85 xd	+ ⅜	4 2 4
Metropolitan District Ord.	100	Nil	Nil	41 — 41½	+1	Nil
Do. 6 % Deb.	100	6	6	139 —141	..	4 4 0
Do. 4 % Deb.	100	4	4	93 — 95	..	4 2 6
Do. 4 % Prior Lien	100	4	4	99 —101	..	3 19 8
Do. 4½ % First Pref.	100	4½	4½	89 — 91	..	4 18 11
Do. 3½ % Gtd.	100	3½	3½	75 — 77 xd	+ ⅜	4 10 11
Metropolitan Elec. Trams, Ord.	1	6	5†	1/16 — 1/8	..	5 1 1
Do. 5 % Pref.	1	5	5	3/16 — ¼	..	5 14 8
Do. 4½ % Deb.	100	4½	4½	89 — 92	..	4 17 10
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Potteries, Ord.	1	3½	..	3/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	1/2 — 9/16	+3/32	6 13 4
Do. 4½ % Deb.	100	4½	4½	85 — 88	..	5 2 8
South Metro. Trams, 6 % Pref.	1	6	..	11/16 — 13/16	..	7 7 8
Do. 4 % Deb.	100	4	4	65 — 70	..	5 14 4
Underground Elec. Railways	10	..	..	4½ — 5	..	Nil
Do. "A"	1/-	..	..	33/64 — 33/64	— 1/16	..
Do. 6% First Cum. Inc. Deb.	100	..	6	111½ — 113½	..	5 5 9
Do. 4½ % Bonds	100	4½	4½	98 —100	..	4 10 0
Do. 6 % Income	100	1½	6 †	95 — 96	— ½	..
Yorkshire (West Riding), Ord.	5	Nil	..	2/16 — 3/16	..	Nil
Do. 6 % Pref.	5	3	3†	2⅞ — 3⅛	..	4 12 4
Do. 4½ % Deb.	100	4½	4½	80 — 84	+1	5 7 2

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4⅞ — 5⅛	..	5 7 4
Do. 2nd Pref.	5	5½	5½	4 25/32 — 4 29/32	..	5 14 8
Do. 4 % Deb.	100	4	4	93½ — 95½	+ ½	4 3 9
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	98½ —100½	..	4 19 6
Auckland Trams, 5 % Deb.	100	5	5	101 —103	..	4 17 1
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 12	— ⅛	5 0 0
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	..	6†	101½ —103 xd	+2	..
Brisbane Trams Invt., Ord.	5	8	8†	6⅞ — 7⅜	..	5 8 6
Do. 5 % Pref.	5	5	5	4⅝ — 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100 —103	+1	4 7 5
B. Columbia Elec. Rly., Def.	100	8	..	141 —145	—1	5 10 4
Do. Pref. Ord.	100	6	6	120 —124 xd	+1	4 16 9
Do. 5 % Pref.	100	5	5	105 —108	..	4 12 7
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	101 —103	..	4 7 5
Do. 4½ % Con. Deb.	100	4½	4½	97 —100	..	4 5 0
Calcutta Trams, Ord.	5	7	5†	5⅜ — 6½	..	5 12 0
Do. 5 % Pref.	5	5	5	4 13/16 — 5 7/16	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	97 —100	..	4 10 0
Cape Electric Trams	1	2½	..	3/8 — 3/8	..	..
City Buenos Aires Trams (1904)	5	5	5†	5 7/16 — 5 11/16	..	4 8 0
Do. 4 % Deb.	100	5	5	97 —100	..	5 0 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 97	..	5 2 1
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	7/16 — 9/16	..	Nil
Do. 5 % A Deb.	100	5	5	83 — 88	..	5 13 8
Do. 6 % B Deb.	100	6	3	30 — 40	..	..

La Plata Elec. Trms, Ord.	1	Nil	..	17/32 — 21/32	..	..
Do. Pref.	1	6	..	29/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1 — 1½	..	4 16 0
Do. 6 % Pref.	1	6	6	1 — 1½	..	4 16 0
Do. 5 % Deb.	100	5	5	91 — 95	..	5 5 8
Madras Elec. Tr. (1904), Deb.	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	87 — 90	..	5 11 1
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100½ — 102½	..	4 17 7
Mexico Trams Com.	$100	7	7†	111 —113	+1	6 8 11
Do. Gen. Con. 5 % Bonds	..	5	5	96½ — 98½	— ½	5 1 6
Do. 6 % Bonds	100	6	6	100½ — 102½	..	5 17 1
Para Elec. Rlys. & Lt., Ord.	5	10	10†	7½ — 8	..	6 5 0
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	98 —100	..	5 0 0
Perth (W.A.) Elec. Tr., Ord.	1	5	5⅛	1 3/32 — 1 5/32	..	3 14 6
Do. 5 % 1st. Deb.	100	5	5	105 —108	..	4 12 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅜ — 5⅝	..	5 0 0
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 10 11
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	101½ —103½	+ ½	4 16 7
Do. 5 % Mort. Bonds	100	5	5	96½ — 98½	..	5 1 6
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	103½ —105½	..	4 14 9
Singapore Trams, 5 % Deb.	100	5	5	86 — 90	+3½	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	97 —99 xd	..	5 1 0
Un. Elec. Trams Monte Video	5	7	6†	5¼ — 5⅜	— ⅛	6 1 9
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	99 —102	..	4 18 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	¾ — 13/16	..	8 0 0
Do. 6 % Pref.	1	6	6	1 1/16 — 1 1/8	..	7 7 8
Babcock & Wilcox	1	28	14†	8 3/16 — 8 5/16	+ 1/16	3 18 8
Do. Pref.	1	6	6	1 3/16 — 1 5/16	..	4 0 0
British Aluminium, Ord.	1	Nil	..	1 — 1	+ 1/16	..
Do. 6 % Cum. Pref.	1	Nil	..	1 — 1	+ 1/16	..
Do. 5 % Prior Lien Debs.	100	5	5	91 — 94	+ 1	5 6 5
Do. Deb. Stk.	100	5	5	86 — 89	..	5 12 4
B.I. & Helsby Cables	5	10	8†	8 — 8½	..	5 17 8
Do. Pref.	5	6	6	5⅞ — 6 1/16 xd	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	96 — 98	+1	4 11 10
British Westinghouse, Pref.	3	Nil	Nil	1/2 — 9/16	..	Nil
Do. Deb.	100	4	4	58 — 61	..	6 11 2
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Brown, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ½	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	73 — 78	..	6 8 2
Do. 4½ % Deb.	100	4½	4½	47 — 52	..	8 13 2
Do. 4½ % Second Deb.	100	4½	4½	28 — 32	..	14 1 4
Callender's Cable	5	15	10†	11 — 11½	..	6 7 8
Do. Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Castner-Kellner	1	20	20	3 1/16 — 3 1/8	..	5 5 0
Do. Deb.	100	4½	4½	105 —108 xd	+ ½	4 3 4

Crompton & Co.	8	Nil	..	½ — ¾	..	Nil
Do. Deb.	100	5	5	55 — 57	..	9 15 6
Dick, Kerr	1	5	Nil	1 3/16 — 1 5/16	..	..
Do. Pref.	1	6	6	1 — 1	..	6 17 2
Do. Deb.	100	4½	4½	95 — 99	..	4 11 10
Edison & Swan, A, £8 paid	5	Nil	..	0 — 1/16	— 1/8	Nil
Do. fully paid	5	Nil	..	1 — 1 1/16	..	Nil
Do. 4 % Deb.	100	4	4	61 — 65	+1	6 3 1
Do. 5 % Second Deb.	100	5	5	72 — 75	..	6 18 4
Electric Construction	2	2⅜	3⅜	1 1/16 — 1 1/8	+ 1/16	5 14 4
Do. Pref.	2	7	7	1 15/16 — 2 xd	+ 1/16	7 0 0
Greenwood & Batley, Pref.	10	7	7	7½ — 8	..	8 6 8
Do. Deb.	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	9½ — 10⅜	..	..
Do. Deb.	100	4	4	90 — 95	..	4 4 8
Henley's, Ord.	5	17	5†	12½ — 13½	..	6 6 0
Do. Pref.	5	4½	4½	4½ — 5½	..	4 7 10
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	..	7½	10 — 11	..	6 16 4
Do. Pref.	10	5	5	9½ — 10½	..	4 17 7
Telegraph Construction	12	17½	5†	34½ — 36½	..	5 13 0
Do. Deb.	100	4	4	95½ — 98½	..	4 1 8
Willans & Robinson	1	Nil	..	1/16 — 1/8	..	Nil
Do. Pref.	5	Nil	..	½ — ¾	..	Nil
Do. Deb.	100	4	4	57 — 59	..	6 15 7

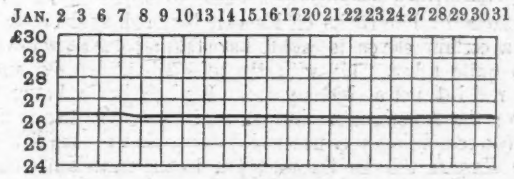
* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 17th, 1912.

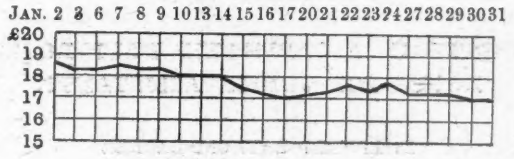
METAL MARKET.

Fluctuations in January.

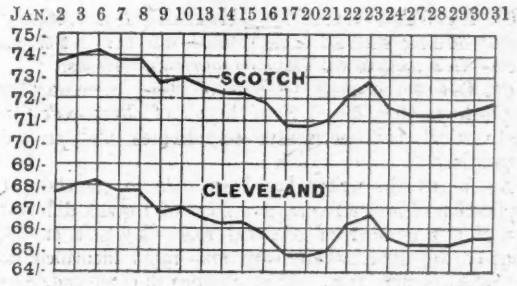
SPELTER (G.O.B's.).



LEAD (ENGLISH).



IRON.



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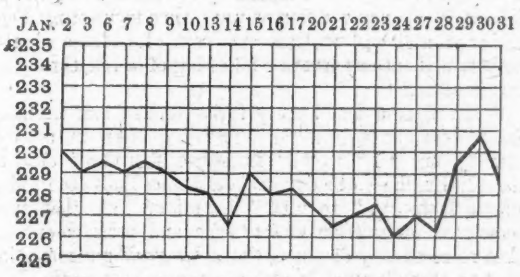
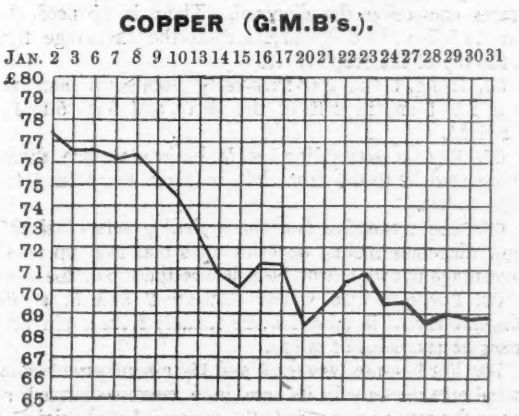


COPPER (G.M.B's.).



Rail Welding.—Messrs. Thermit, Ltd., London, have contracts in hand—or shortly to be started—for the welding of the tramway rails on the following, among other systems:—Ayr, Bolton, Birmingham, Dublin, London County Council, Manchester, Portsmouth, Salford, York, &c. The number of joints welded on new and reconstruction work during 1912 amounted to over 15,000, which is equivalent to nearly 90 miles of single track, 60-ft. rails.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

The writer of these notes has just received the Electrical Review of January 3rd, which contains the report of Mr. C. Hamilton Wickes on the Chicago Laboratories.

Mr. Wickes has carefully gathered his facts and marshalled them well, for he sets out the existing state of affairs very accurately. The most noteworthy of his statements are the following:—

I. The third paragraph of the report, relating to the ". . . other difficulties appertaining to the position . . ."

II. The last paragraph under the heading "British Manufacturers *v.* the Operations of the Underwriters' Laboratories, Chicago."

III. Also Secs. 2, 4 and 5 under the same heading.

The statements referred to in 1 are self-evident truths to anyone acquainted with this Continent, and need no comment.

The question of danger to life (Sec. 2) is an important one, as neither the U.L.C., nor any of the bodies associated therewith, are in a position to enforce rules on this point; the only thing that they can do is to make recommendations. The sole means which the Underwriters possess of enforcing their rules is to raise the insurance rate or refuse insurance altogether; manifestly, then, as they do not insure lives they are quite powerless where life hazard comes in, except in so far as this may be introduced through fire. Even in respect of the fire risk, if this be not excessive and the business is good, the rules are frequently winked at.

From this it is plain that, if a person cares to take the risk of being without insurance, or of insuring with a company outside the Fire Underwriters' organisation, he can please himself what he does. As for the electric supply companies, some of them will connect up to any pair of terminals without much question as to what is on the side remote from their mains.

It seems a great pity that the U.L.C. are not supported by the Life Assurance companies as well, because, if this were so, proper safeguards against shock would immediately be taken and enforced. Even this arrangement, however, would fall a little short of the ideal, as some people do not insure at all.

Mr. Wickes refers (Sec. 3) to "the intolerable state of affairs" which necessitates British-made products, intended for "a portion of the British Empire," being approved or rejected by a foreign corporation.

This is exactly the view of the situation taken by the writer and already set forth in these "Notes" some little time ago.

Secs. 2, 4 and 5, referred to in III above, are all closely related, and may be considered together.

The Imperial Trade Commissioner remarks: "I think he" (the British manufacturer) "should be supported in this objection, unless, indeed, we are prepared to concede that the United States engineer is the repository of all the wisdom of the world . . . ." It would be one thing for a Britisher to refrain from conceding such a point, but quite another to induce the "United States engineer" to join in the *refrain*, at least so far as this continent is concerned.

The statement that "the introduction of new methods or fresh standards might meet with considerable opposition" is very much too mild, for it may be confidently predicted that the "opposition" from the "manufacturing," and some of the "other Mercantile Associations," would be of a very determined character, if any such step as that recommended by Mr. Wickes were under contemplation.

It is not to be denied that the U.L.C. have done practically all the pioneer work and are efficiently performing a duty not undertaken on this side by any other body. This is all very well for the States, but when one turns to Canada it is regrettable to find the British manufacturer practically shut out from certain lines.

Mr. Wickes, in discussing the suggestions at the end of his report, thinks that the adoption of his third proposal "would throw open to our British manufacturers not only the Canadian, but the American, market."

Supposing that the American manufacturer came to the same conclusion—would he, supporting the U.L.C. as he does,

quietly submit and allow his markets to be thus thrown open, or would he not rather rise up and, in every way possible, strenuously fight the matter—there seems to be only one answer to this; he would also have the strong, and not-to-be despised, co-operation of the electrical contractors and jobbers who are naturally in close touch with the manufacturers.

If the American market cannot be "thrown open" (to say the least the task would be difficult), what about the Canadian one? If the Canadian fire underwriters be willing to forgo the U.L.C. inspection and specifications, and accept those of a British laboratory, this might be done. If, however, this latter be merely an "offshoot" (or, shall we say, an "adjunct") of the U.L.C., it may be taken for granted that practically no new methods or standards would be introduced over here; the matter would, therefore, resolve itself into the British manufacturer being compelled to get out new drawings, tools, jigs, &c., in order to make apparatus and fittings which would comply with the American standards. To some extent this procedure is inevitable if any Canadian trade is to go to Great Britain, but the situation might be mitigated were the problem of securing this trade for the home country attacked in a somewhat different way from that recommended in the report now being criticised. In view of the, as yet, comparatively small size of the Canadian market, the British manufacturer must ask himself seriously—"Will it pay to go to the expense of getting out new standards, tools, &c., for the sake of obtaining a *share* of the Canadian trade if, as seems likely, no American trade can be looked for?"

Of course, it pays him to supply material and goods of his own standards, and, in regard to meters, motors, large cables, &c., he is allright in this country now, but when it comes to small switches, lampholders, fuses, ceiling roses, &c., the design of which is covered in the specification of the U.L.C., the case is very different.

Mr. Wickes's suggestion to extend the policy to other parts of the Empire is a very good one, but it must be remembered that in most, if not all, other parts of the Empire, except Canada, British, and not American, standards and designs are predominant. Canada's position is quite unique in this respect, as was pointed out in the columns of the REVIEW a little while ago.

In the opinion of the writer, the best way of dealing with this problem would be to combine Mr. Wickes's first and second proposals, *i.e.*, that laboratories should be established both in Canada and in England, these, of course, to work in conjunction with each other, and be independent of the U.L.C., though not essentially antagonistic thereto.

Probably it would be difficult to establish a fully-equipped laboratory here for some years, so that elaborate tests, when required, might be carried out in England (if need be, at the National Physical Laboratory), under the supervision of both Canadian and British engineers. Mere inspections, labelling, &c., could readily be done both here, for the Canadian manufacturer, and in England, for the British manufacturer.

The system established in the U.S.A., and at present operative here, of having all fittings, &c., made to the standard specifications of the U.L.C., is an excellent one, and as all municipalities, &c., adopt the one set of rules, viz., the National Electric Code, the training of wiremen and the ordering of material are very much simplified as compared with English practice.

Many of the devices used and methods adopted are eminently suited to the conditions of the country, and it would be both unnecessary and unwise to alter them, but the British manufacturer labours under great disadvantages at present, even though he be prepared to supply goods in strict accord with U.L.C. requirements.

The Imperial Trade Commissioner for Canada is to be heartily congratulated for having grasped the situation so well in the short time he has spent in the Dominion, but your correspondent takes issue with him on the method which he recommends for the removal of the disadvantages just referred to. The work of a British laboratory, which was merely an "off-shoot" of the U.L.C. would not, in the opinion of the writer, help the British manufacturer much in his trade relations with this continent; rather would it tend to "throw open" the markets of the Empire to the American manufacturer, as, with a laboratory in England practically subordinate to one which is in constant touch and already thoroughly acquainted with his own products, every possible influence would be exerted to enable him to introduce his wares into other British possessions with the object of making them standard there in place of designs of British origin.

If the British manufacturer wants to strike in his own interests let him strike off his own bat, and, as the captain of a certain eleven is said to have told a batsman who was not quite sober, "hit with the *middle* bat," too, *i.e.*, with the real bat, not a visionary one. It would be far better to leave the American market alone, if the attempt to secure it (success being very uncertain) means that the markets of the Empire will be thrown open to the American manufacturer.

GRAPHS IN A CABLE-SHIP DRUM-ROOM: NOTES FOR JUNIOR ASSISTANTS.

By EDWARD RAYMOND-BARKER.

(*Continued from page* 154.)

63. Fig. 6 shows a complete cable-slack-per-cent. calculator board* dealing with all cable values—whether in N.M. or in knots—*in a manner involving no converging origins.*

64. One of the main features of these calculator-board graph-sheets (figs. 6 and 7) is the use of *Morse-code figures* for vertical and horizontal co-ordinates and *percentage* diagonals.

As far as the writer has been able to ascertain, this application of Morse figures as a means for quick differentiation of any number of sectional lines, diagonals, curves, or lines of any kind where easy and rapid identification is desirable, is quite new. This system will commend itself to draughtsmen, hydrographers, chart-makers and others, embodying as it does a simple way of drawing any number of lines in as many different ways, thus facilitating identification of a given line, from one part of a large chart to another, without any irksome following of a line throughout its entire length.

65. In figs. 6 and 7 every fifth vertical and horizontal line is continuous, whilst intervening lines in all cases severally are "1" to "4" in Morse figures of *dots* and *dashes*. Similarly, the diagonal *percentage* lines are in Morse figures from "1" to "20" inclusively, so that where rectangular intersection of *taut wire* and *cable* co-ordinates takes place on any diagonal, the *cable-slack percentage* indicated by that diagonal is at once recognised in the Morse figures composing the diagonal. There is no need, therefore, to follow the diagonal line up to the percentage figures at the top of the graph sheet.

66. In fig. 6 the *taut-wire* vertical-scale divisions range from 2 to 5 on the left of the sheet, and from 5 to 10 on the right.

67. The corresponding *cable* horizontal-scale divisions range from 2 to 6·5 from left to right and from 5 to 12, right to left.

68. The respective two corresponding sets of *slack-per-cent.* diagonals incline opposite ways and lead up to slack percentage figures clearly inscribed at the top of the sheet.

69. For taut-wire values between 2 and 5, a single diagonal thread is used, moving radially from a pin attachment at the point of origin.

70. For like use between 5 and 10, a transparent celluloid radial arm moves with its base in a curve so formed as to cause the arm to move radially on an inferred origin—that is, on that common point of origin towards which the diagonals tend to converge. Movement of the radial arm causes its straight-edge to coincide successively with the various percentage lines. In fig. 6, this coincidence is not absolute, because, when the photograph was taken, the upper end of the radial arm was not close up to the board, but must have been hanging away slightly from it.

* Maker: W. H. Harling, 47, Finsbury Pavement, London, E.C.

71. So much for *length* and *speed* values between 2 and 5, and between 5 and 10. What provision, then, is to be made for values between *zero* and 2? As far as values 0 to 1 are concerned, these naturally will be the same as those from 0 to 10, any difference depending merely on the position of a decimal point. What *are* wanted are the values between 1 and 2.

72. Hence, on the calculator board shown in fig. 6, which, to facilitate the verification of co-ordinates, is fitted with horizontal and vertical cursor threads, an *extra set* of vertical and horizontal axes, also diagonals, have been provided on an extended scale.

Taut wire vertical scale : 1 to 2.
Cable horizontal scale : 1 to 2·6.

The corresponding diagonals are seen, in fig. 6, to the right of the others.

75. On the other hand, supposing that with a *taut wire* rate of 7·5 knots, it be desired to lay about 6·5 per cent. of cable slack.

(1). Horizontal cursor is placed at 7·5.

(2). The radial arm is then moved on its curved base till the straight-edge lies about half-way between the 6 per cent. and the 7 per cent. diagonals.

(3). The vertical cursor, on being brought to the intersection of radial arm and horizontal cursor, is found to indicate the required cable rate, viz., eight knots.

76. Thus it is seen that the calculator-board, fig. 6, fulfils all percentage conditions between 0 per cent. and 20 per cent., without any converging origins.

77. After what has gone before, fig. 7 will be found self-explanatory. It shows a calculator board* specially designed by the writer for paying-out purposes, and for giving, at a glance, for all types of cable on board a ship, the required

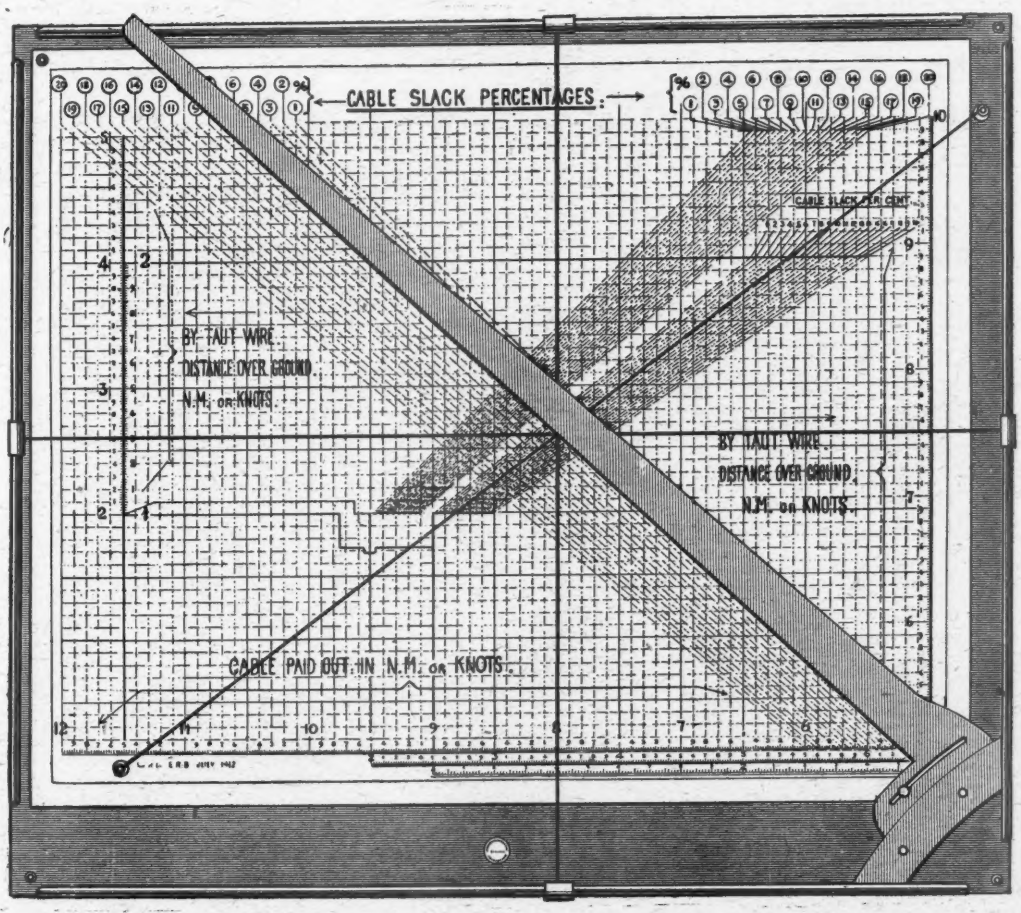


Fig. 6. (Sectional sheet, reduced from 700 mm. × 500 mm.)

73. In connection with these last, an example may be cited.

Supposing *taut wire* paid out = 130 N.M.
Horizontal cursor placed at 1·3 (see fig. 6).
Supposing *cable* paid out = 140 N.M.
Vertical cursor placed at 1·4.

Radial thread caused to cut the two cursors at their point of intersection is found to lie between the 7 per cent. and 8 per cent. diagonals. Actual slack = 7·7 per cent.

74. Second example (see fig. 6).
Let *taut wire* be going out at 7·5 knots.
Horizontal cursor placed at 7·5.
Let *cable* be going out at eight knots.
Vertical cursor placed at 8·0.

Straight-edge of radial arm brought to traverse point of intersection is found to coincide with a position a little over half-way between the 6 per cent. and the 7 per cent. diagonals.

Actual *slack* = 6·6 per cent.

cable-drum *revs. per minute* corresponding with any likely rate of laying that might be adopted.

78. Below the horizontal cable scale is a space into which, for any cable-laying expedition, may be pinned a fresh table of corrected drum revs. per minute values, so written, and arranged, that the several sets of values for the various cable types on board, lie in line with the corresponding graduations of the cable knots horizontal scale.

79. The afore-mentioned table would be based on a formula developed from data given in 36 and 37—

$$\text{Drum revs. per minute} = \frac{\text{cable N.M. per hour}}{\text{1 drum-rev. in N.M.} \times 60}$$

(all values corrected, see 36 and 37).

80. In fig. 7 (on the extra slip of canvas paper pinned in afresh for each expedition) there are *drum-revs. per minute* columns given for *eight* different cable types.

* Made by W. H. Harling, of 47, Finsbury Pavement, London, E.C

81. The positions (as shown in fig. 7) of the thread-cursors afford an example of the general working of this calculator board.

Wire going out at 118·3 measuring-wheel *revs. per min.* = 7·1 knots : speed of ship.

Horizontal cursor at 7·1.

Cable type B going out at 45·7 drum *revs. per min.* = 8·1 knots. Vertical cursor at 8·1.

The two cursor threads are then seen, at a glance, to intersect on the cable-slack diagonal of 14 per cent.

82. Conversely, if with *wire* going out at 7·1 knots, it be desired, for certain reasons, to lay over a particular part of the cable route, slack to the extent of 14 per cent., the *wire* horizontal cursor is placed at 7·1 and the *cable* vertical cursor is brought to the point of intersection between the horizontal cursor and the 14 per cent. diagonal. The vertical cursor then automatically indicates not only the necessary cable rate in knots, for any cable type, but also, the corresponding *drum-revs. per min.* necessary to produce that same paying-out rate.

83. If the graph method involved in fig. 4 be used (see 38) the 1 drum-rev. in the formula (see 79) is left

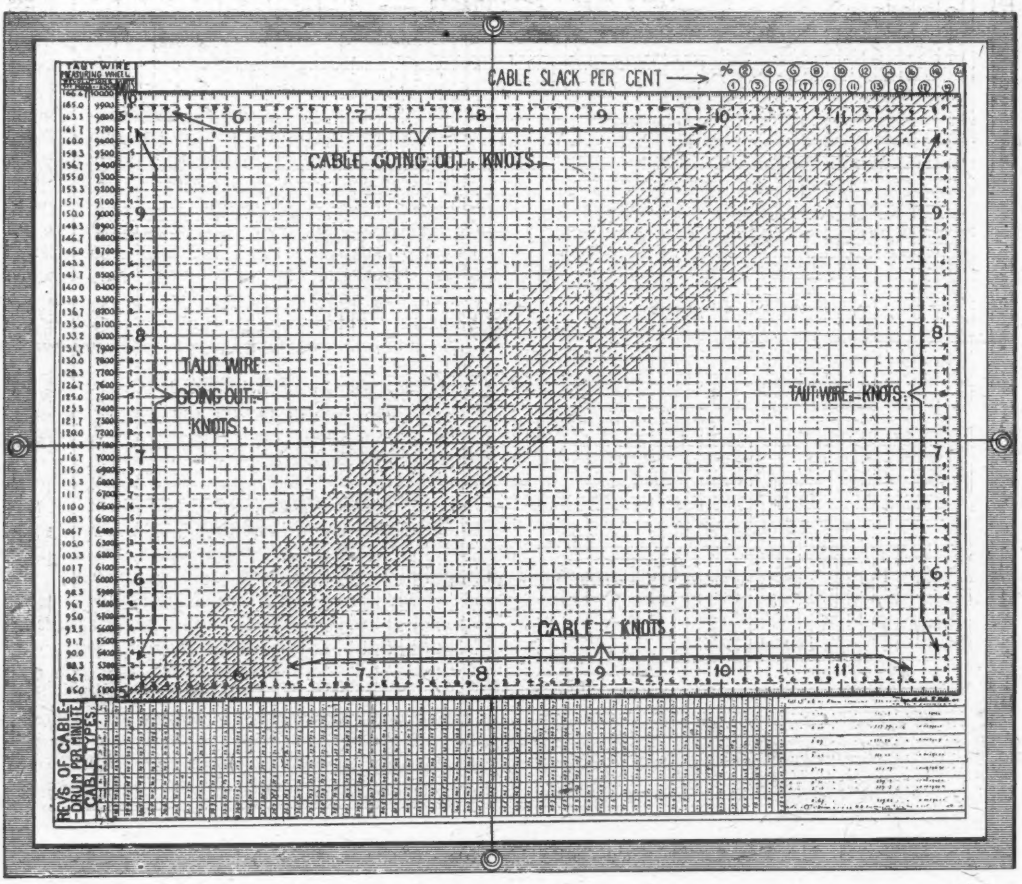

CABLE SLACK PER CENT
CABLE GOING OUT. KNOTS.
TAUT WIRE GOING OUT. KNOTS.
TAUT WIRE. KNOTS.
CABLE. KNOTS.
REVS. OF CABLE DRUM PER MINUTE. CABLE TYPES.

Fig. 7. (Sectional sheet reduced from 700 mm. × 500 mm.)

uncorrected for cable circumference, and the formula becomes :—

$$\text{Drum-revs. per min.} = \frac{\text{cable N.M. per hour}}{\text{1 drum-rev. in N.M.} \times 60}.$$

One single table, in that case, would suffice for all types of cable (see 80) the correction for cable circumference being applied at the final stage, by means of data obtained from the curve in fig. 4, in the manner shown in 38 and 43.

84. In practice the cursor threads are best made of the finest *red*-silk-covered elastic.

In fig. 6 the cursor threads are adjusted by brass attachments sliding along rods.

A preferable and more simple method of adjusting the cursors is shown in fig. 7. The threads are attached to glass "photographic" pins easily inserted, at pleasure, anywhere along the cork strips let into the calculator-board frame.

85. With the scales, sectional lines, figures, and data available, innumerable changes may be rung by means of these calculator boards, in the manipulation of percentage and other figures.

(To be continued.)

LEGAL.

Interesting Tramway Case at Bradford.

At the Bradford City Police Court on Friday, the Stipendiary Magistrate (Mr. H. W. W. Wilberforce) delivered judgment in a case in which a man travelling on a Leeds Corporation car was summoned for using obscene language. The Stipendiary Magistrate said : "This summons alleges a breach by the defendant of one of the Tramway By-Laws of the Bradford Corporation, in using obscene language upon a tramcar. The facts are not really in dispute, but the question arises whether the by-laws apply to a particular tramcar upon which the obscene language was used. The car was the property of the Leeds Corporation, and was running upon Bradford tramlines in pursuance of an agreement between the two Corporations entered into under the authority of Sec. 12 of the Bradford Act, 1899. (Sec. 12—"The Corporation on the one hand, and the owner and lessee of any trams or light railway in any adjacent district which can be worked with any of the Corporation trams on the other hand, may from time to time enter into and carry into force contracts and agreements with respect to the purchase, sale, lease, working or management and maintenance by the contracting parties, of all or any of their respective tramways, light railways and works, or any part or parts thereof respectively ; the making of all necessary junctions, the supply under any agreement for all or any of the respective tramways or light railways of the contracting parties being worked by the other of them as aforesaid, and rolling stock, plant, machinery and electrical energy or power necessary for the purpose of such agreement ; the appointment and removal of officers and servants the payments to be made and the conditions to be performed in respect of such working or management and maintenance ; the interchange, accommodation, conveyance, trans-

mission and delivery of traffic, coming from or destined for the respective undertakings of the contracting parties, and the diversion and apportionment of the revenue arising from such traffic and the payment of any fixed or contingent rent.") The point was, therefore, can this tramcar, although the property of the Leeds Corporation, be said to be a carriage belonging to the Bradford Corporation, within the meaning of the section of the Act of 1870. It need hardly be said that it would be the height of absurdity that a tramway passenger in Bradford who finds himself in a car which happens to be the property of the Leeds Corporation running in Bradford, should therefore be able to commit nuisances with impunity. Still, this absurdity, if it existed, would not be due to the Act of 1870, which neither contemplated nor authorised the subsequent development of municipal enterprise, but to omissions in the various private Acts, which sanctioned this development. This consideration, accordingly, is irrelevant to the interpretation of the language of the section. Now, looking to the words themselves, it is to be said that in their ordinary use "belonging to" may bear a variety of meanings, ranging from absolute ownership to a connection or relation of a very much slighter kind, and in this particular section the meaning cannot, I think, be limited to absolute ownership. For instance, if a car were hired, whether on a hire-purchase agreement, or for a period, by the Bradford Corporation from the makers, and not bought outright, such a car would, I take it, be within the meaning of the section. So, too, if a car is lent on approval to the Corporation. Considerations of this kind seem to me to give to the words a meaning in this section rather of possession and control than of ownership, and accordingly it becomes necessary to inquire what was the position of the Bradford Corporation in reference to this particular car. Broadly speaking, the result of the agreement between the two cities as to cars, the property of Leeds, running in Bradford, is that Bradford pays the working expenses of the car, receives the fares, and has control of the car and the men in charge of it. I do not lose sight of the fact that these cars are alluded to in the agreement as "belonging to Leeds," and that claims for damage caused by the cars, or those in charge of them, are to be satisfied by Leeds. Looking, however, to the agreement as a whole, the possession and control of this car was, in my opinion, clearly with the Bradford Corporation. That being so, although my opinion has wavered, and I regret that the case has not been argued on the other side, I come to the conclusion that this possession and control brings the tramcar in question within Sec. 46 of the Act of 1870, and therefore within the similar, though not identical, words of the Corporation by-laws. There will, accordingly, be a conviction. Defendant will be fined 2s. 6d. and 13s. costs.

Barnsley Corporation *v.* Barnsley Motor Omnibus Co., Ltd.

At the Barnsley County Court last week, the plaintiffs sued defendants for £25 damages done to an electric switch-box. The case occupied considerable time. It appeared that on the night of October 24th last a taxi-cab belonging to defendants collided with an electric pillar-box. The street was 27 ft. wide. The cab struck the box in avoiding a tramcar. Immediately the box, which contained the electric main for the town's lighting system, was struck, the wire fused, and the whole town was plunged into darkness for a time. The defendants had maintained that the cause of the mishap was the state of the tramway. It was stated, however, that the borough engineer had examined the site and found that the condition of the tramway was such that it could not even be a contributing cause to the accident. The defendants pleaded that the affair was a pure accident, owing to the greasy state of the road, and the onus was on the Corporation to show that there had been negligence. At this point, near a dangerous corner, it was the practice of motor-drivers to drive in the middle of the road, and very properly so. They maintained that the wheels of the taxi-cab caught in the tramline, and the cab skidded into the pillar-box. His Lordship eventually gave judgment for the defendants, with costs.

The Graetzin Lamp Agency Judgment.

In our summary of the judgment in this case last week, an error occurred in the first five lines on page 176. What should have been reported will be gathered from the following extract which we have made from a *verbatim* copy of the judgment that we have since seen :—

"If I should be wrong in holding that the interpretation of the contract is governed by German law, I should have held at English law that the *defendants* had no right to cancel the first contract of Krupka & Jacoby, so as to avoid paying the plaintiff commission on the guaranteed sums; that they had no right to make the contract of February, 1912, without the plaintiff's consent."

Collision between Tramcar and Motor-Car.

In the King's Bench Division on January 31st, Mr. Justice Bucknill and a special jury concluded the hearing of an action in which Mr. Leslie Montague Sarll, formerly of Richmond and now of Chelsea, claimed damages from the London United Tramways, Ltd., for injury to his motor-car by a collision with one of the defendants' tramcars. The accident happened on February 10th of last year, under a railway arch which crosses the Kingston and Malden Road in Surrey, the roadway under which is not sufficiently wide for ordinary vehicles to pass a tramcar, and each party contended that the other ought to have given way.

The question was entirely one of liability, the amount of damage done having been agreed between the parties at £207 in respect of the plaintiff's motor-car, and £1 13s. in respect of the tramcar, for which the defendants counterclaimed.

The jury, in the result, found for the plaintiff on both claim and counterclaim, expressing an opinion that the motor-car was under the archway before the tramcar.

Osram Lamp Co., Ltd., *v.* The Oro Lamp Co., Ltd.

In the Chancery Division on Friday, January 31st, Mr. Justice Swinfen Eady had before him a motion in this action.

Mr. Gray stated that it was a motion to restrain an alleged infringement of patent rights. The parties, however, asked for a week's adjournment, defendants undertaking not to commit the acts complained of during that time.

His Lordship : Very well.

The Singapore Electric Tramways, Ltd.

On a petition by this company, Mr. Justice Joyce in the Chancery Division sanctioned a reduction of its capital from £400,000 to £100,000. It was stated that the difference between those two sums was the amount of capital lost or unrepresented by available assets, and the reduction was to be accomplished by reducing the £1 shares to shares of 5s. each.

Mr. Hughes, K.C., and Mr. J. W. H. Holmes appeared in support of the petition, and there was no opposition.

Smith *v.* Stanton Iron Works Co. Collieries, Ltd.

The Master of the Rolls and Lords Justices Buckley and Hamilton heard an appeal by the dependants of Wilfred Smith, a boy of 15, from the refusal of the Judge of the Mansfield County Court to make an award against the company in respect of the boy's death, on the ground that the accident causing death did not arise out of, or in course of, his employment.

Mr. Ward (for appellants) said that the lad was employed as "electric motor driver," and had to work in a shed 27½ ft. long; at one end was a motor switchboard, which the boy worked according to signal. Another part of his duty was to oil and clean an engine in the shed when it was at rest. The boy was found dead on the cog-wheel of the electric motor. Counsel submitted that it ought to be presumed that he met his death in the course of his employment, either in oiling or cleaning the engine.

The Court dismissed the appeal without calling on the other side, and the Master of the Rolls said that no fact had been found in the case which would justify the inference that the unfortunate accident arose out of the boy's employment. The explanations put forward on behalf of appellants were mere guesswork, and that was not enough.

Post Office Telephone Charges.—Customers' Complaints.

In the City of London Court, on January 30th, the Postmaster-General sued the British Motor-Cab Co., Ltd., Pimlico, for £4, balance for removing a switchboard from one room to another.

Mr. L. C. Bullock, defendants' solicitor, said that one of the Postmaster-General's responsible officials obtained an undertaking from the defendants under misrepresentations. A verbal price of £2 to £3 was given, and yet the Postmaster-General charged £7.

Mr. Macintyre, for the Postmaster-General, said there was no doubt that an estimate of £2 to £3 was given, but before the work was done defendants were required to give an undertaking to pay the charges, whatever they were, as they could not be determined before the work was done. It was a large switchboard that had to be removed. In the ordinary course the cost would have been £17, and the Postmaster had charged £7.

Mr. Bullock said that the engineer to the Post Office specified that the cost would be £3 at the outside.

Mr. Weyman, the engineer, said that the work was delayed at the request of the defendants, and that increased the cost. There was no standard price for removing a switchboard. An undertaking always had to be given to prevent the public having to pay for the delays of subscribers. At first they charged £9, and then reduced it to £7.

Judge Rentoul said it was a question whether the defendants had not been misled unintentionally as to the amount.

Mr. Bullock said they would not have had the work done had they known it was to cost £7. They had paid £3.

Mr. Macintyre urged that the Crown was not bound by what a servant chose to say. The engineer was pressed to give a figure, and said £3. He had no authority to quote a price. That was why the undertaking was required.

Judge Rentoul said he had never known Mr. Macintyre to be wrong before. He was on that occasion.

Judgment for the defendants, with costs, with leave to appeal.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

New G.E.C. Balancer Starter.

The General Electric Co., Ltd., have recently designed a special type of starter which possesses several original features, and avoids the use of a no-volt release. The new arrangement consists

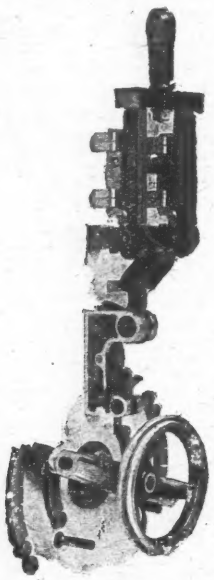


Fig. 1.—G.E.C. Patent Balancer Starter.

of a main switch which is interlocked with a starter, so as to ensure the following sequence of operations :—

1. That the starter must be in the "off" position before the main switch is closed.

2. If the main switch is opened when the starter is in the full "on" or any intermediate position, it cannot again be closed until the starter arm is moved to the "off" position.

It will thus be seen that the dangers connected with the "no-volt" type of balancer starter will be obviated.

Distribution Boxes.

We illustrate in fig. 2 one of a line of distribution boxes, which has been developed by Messrs. A. Reyrolle & Co., Ltd., Hebburn-on-Tyne, to meet the Home Office Regulations. The boxes are of stout cast iron, fitted with latched doors, and the range of sizes runs from a single-way 25-ampere box up to a nine-way 400-ampere box. The fuse handles are of the firm's well-known patent self-aligning type, and, as we recently explained, these are not now

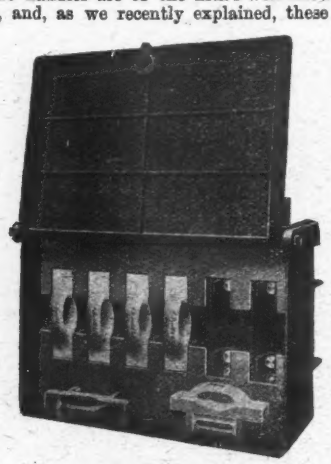


Fig. 2.—Reyrolle Distribution Box.

fitted with buttons on the front, thus removing what might have been a source of danger in the event of a button breaking. The space between the porcelains of the individual fuse handles is fitted with insulating screens, and, where different poles or phases are brought into the same box, vertical screens are fitted.

New Wandsworth Switches.

The Wandsworth Electrical Manufacturing Co., Ltd., of Ludgate Hill, Birmingham, have recently introduced a new switch—the A1—which is shown in the "on" and "off" positions in fig. 3. The movement of this switch is new in principle, and unique in construction and design. The main feature is a spring-influenced cam with a double-fly action. The springs are in tension during the initial movement of the dolly in either direction, and then re-act through the cam, to force the switch-arm into or away from the contacts, irrespective of any further movement of the dolly. These springs also serve to look the switch in both "on" and "off" positions. The switch has an easy action, and it is impossible to get an intermediate position. The switch cannot be held in partial contact by the operator. The action of the switch has been covered by letters patent.

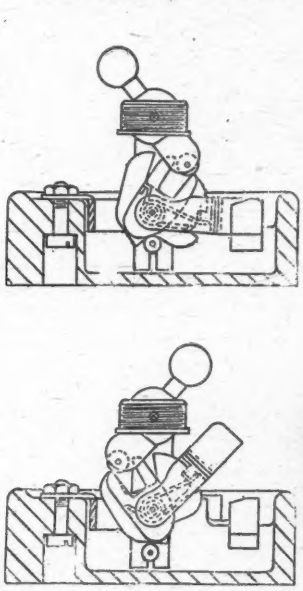


Fig. 3.

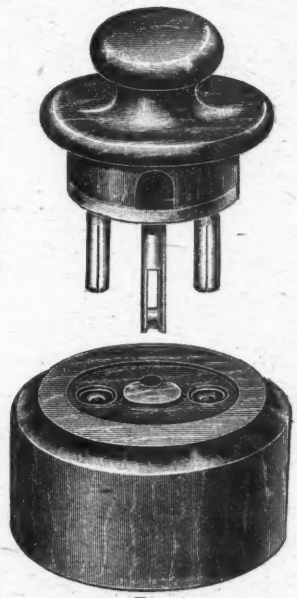


Fig. 4.

New Wandsworth Switch and Switch-Plug.

A further combination of switch A1 with an ordinary plug and socket, fig. 4, is so arranged that the action of pushing the plug into, or withdrawing it from, the socket automatically moves the switch to the required position. As in switch A1, it can never be held or left in such a position as to make only partial contact. There is no intermediate position between "on" and "off." The circuit is automatically made and broken by the switch and not by the plug. It can be fitted with an earthing device if required. This combination switch plug has also been patented.

The "Indra" System of Lighting.

The "Indra" patent system of light distribution, which is being introduced by the Electrical Engineering and Equipment Co., Ltd., 109-111, New Oxford Street, W., is a mode of lighting whereby a very high general illumination can be secured, or the light can be directed to illuminate brilliantly a given area without the eye strain consequent upon the use of naked lamps and reflectors. In the "Indra" system the actual source of light is not seen, yet the bulk of the light is directly reflected through clear glass. A simple fitting consists of a combination of specially

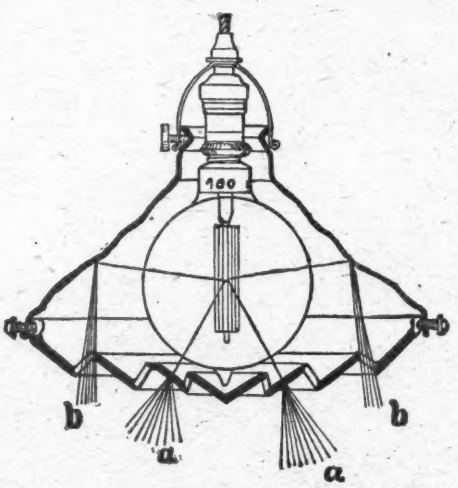


Fig. 5.—Section of "Indra" Fitting.

designed upper reflector and lower distributor. The upper reflector is preferably of opal glass, but where the whole of the light is required in a downward direction, an aluminium reflector is supplied. The lower plate (fig. 5) is provided with alternating rings of clear and etched glass.

As is well known, the bulk of the rays of light from metal-

filament lamps are emitted at right angles to the filament. These rays (*b*) strike the reflector, and are directed through the clear glass rings of the distributor. The rays (*a*) which strike the distributor direct are diffused through the translucent or etched glass rings, so that a very high general illumination is secured without eye strain. From photometric tests which have been carried out, it is found that the illumination is much greater when the "Indra" fitting is used than that from an ordinary lamp with reflector, the eye is not blinded by the brilliant glare, and the general illumination is far superior.

The fittings are arranged to meet all possible requirements of lighting; they can be supplied to focus the light on a given spot or to spread it over a desired area, or to give a general illumination, and are made up in designs suitable for all applications. They are supplied in various sizes, from 8 in. to 20 in., and are suitable for metal-filament lamps ranging from 50 to 1,000 c.p.

Automatic Change-over Switch.

Half the benefit of a duplicate supply of electricity to a theatre or other public building is lost if an appreciable interval of time elapses between the failure of one and the switching-on of the other system, and, where the change-over is effected by hand, such an interval is inevitable—it may be of several minutes' duration if there is no switchboard attendant. An automatic device should, therefore, be provided in all such cases, capable of acting instantaneously and transferring the load to the sound supply with no more than a flicker of the lamps at the most. Such a device has been developed and patented by the Adams Manufacturing Co., Ltd., of Bedford; it consists essentially of two magnetically-operated main switches controlled by a magnetic relay, and is applicable to all cases in which both supply systems are at the same voltage, d.c. or a.c. With suitable modifications, cases where the voltages or systems are not identical can be dealt with. As the conditions vary in each case, the apparatus cannot be standardised to meet all cases, but is made up according to requirements.

REVIEWS.

The Energy Diagram for Gas. By F. W. Burstall. London: Constable & Co., Ltd. 1912. Price 5s. net.

This is a novel presentation of the energy diagram, with special reference to nitrogen, because the specific heat of this gas varies directly with temperature, and that of other gases can be found by the formula K times molecular weight = constant. The units are English, except for temperature, and so it happens that the bastard figure of 1,400 is favoured for J.

Everyone knows the ordinary $p\ v$ diagram for gas. It is easy to explain, especially with the indicator as an aid, for the ordinates so obviously mean pressure, as drawn by the instrument, and the engine draws in its own volumetric abscissæ. But the energy curve is too much of an abstract idea for most men, and it almost seems that the men who could profit by this book are those who could have written it. It has involved an immense amount of work, and will doubtless be of service to those who can use it, but those will be comparatively few. But possibly they will be as many as the author looks for. To the academic variety of author accustomed to the daily use of the higher mathematics, the ignorance of mathematics of the average engineer, and his clumsiness in using it, is either an unknown quantity, or it is beneath contempt. One of these mental attitudes possibly stands behind the fact that there is no list of symbols. The reader is supposed to know what is meant by all those which are employed. If this book was intended to be used by engineers generally, every symbol ought to have been defined. Instead, the first page starts off with the symbol K_p K_v, only to be known by inference. P, V and T are more obvious, but what of *a*, *b*, *s*, *s*? Why define p, v_1, v_2, and omit R?

The fact is that these energy diagrams are outside the unassisted ken of ordinary mortals, and authors will not assist such.

The ordinary engineer can understand the indicator diagram, and knows that the hyperbola is so near to the actual steam expansion curve that an engine will do a little more work than hyperbolic false theory teaches. He knows that adiabatic expansion falls below the hyperbola, and he can find out pretty closely what is really going on in an engine. Cannot the present author state in plain language just how the energy diagram is applicable to practical conditions?

How does the applier need to take cognisance of cylinder effects in the steam engine or the worse jacket cooling effects of the gas engine? If the diagram is to come into real use, it must be fully explained for the benefit of those who, if not mental gymnasts, are sound enough engineers, for steam engine economy has not been brought about by mathematics, but by the application of simple observation. The diagrams with which the book is illustrated are not too easy to read, being a mass of curves and figures. Yet the author places the description of fig. 4 on one page and the diagram on the back of that page. The reader cannot even tear the page out for convenience. Fig. 5 is on page 13, its description on pages 14 to 17. Fig. 6 on page 16 faces the description, as all should. These diagrams should all be plates to lie wholly beyond the book when opened out. Without such an aid no student can follow either diagrams or description without eyestrain and worry. If it be argued that the book is not intended for such as cannot follow its matter with facility we may cease complaint.

Let it be added that the value of the specific heat of nitrogen is that of Holborn and Henning, as given by the formula $K p = 0{\cdot}2246 + 0{\cdot}000038\ T$ and $K_v = 0{\cdot}1541 + 0{\cdot}000038\ T$. The connection between pressure, volume and temperature is $P V = 98{\cdot}86\ T$. T, of course, is absolute. The energy chart has been constructed so that all calculations in connection with the internal-combustion engine can be made with a pair of compasses.

The indicator diagram is transferred to the energy diagram by multiplying the volumes of the indicator diagram by a factor which is the reciprocal of the charge weight. To explain his book, the author considers a series of heat-engine cycles that have been employed and some of which are still employed. He also explains the large diagram for nitrogen which is folded in a pocket in the back cover. This large diagram carries the adiabatic curves from T = 300° C. to 1,600° C. There is a curve of specific heat and scales of velocities, thermal units and absolute temperatures, and also a curve of velocities. An excellent little work, but quite insufficiently explained to the man who perhaps wants it most, while clear enough to him who could have written it, like the author himself.

Primer of Scientific Management. By Frank B. Gilbreth. 1912. London: Constable & Co., Ltd. Price 4s. net.

This book has been written as a reply to the enormous number of inquiries following the publication of "The Principles of Scientific Management," by Dr. F. W. Taylor, in the "American Magazine"; and it is arranged in the form of answers to representative questions concerning the methods put forward by this well-known authority. It is practically a defence of Dr. Taylor's system, and, we may add, a very convincing one; at any rate, such will be the case as regards the employer. To convert the British workman, the subject will have to be dealt with in simpler language.

General principles only are considered, and they are applicable to any industry in which piecework is practicable.

The opinion that the details of the American system of management are needlessly complex is widespread in this country, but that the general principles are correct and worthy of study will be freely admitted by all who have followed Dr. Taylor's investigations regarding cutting speeds and other features of production.

Under the old system of works management a drawing was sent into the machine shop showing the finished part, but no instructions were issued as to how the work was to be done or what tools were to be used. This system was improved upon by the introduction of jigs, and some attempt to provide tools of the best form for cutting various metals at the highest speeds, but the workman still had to rely upon the foreman and his own ingenuity to turn out the job in the quickest way. Then followed the recording of the times taken, which enabled a specialist to forecast, to some extent, the correct allowance of time for new work. This was all very good in its way, but the results were not accurate enough for the fixing of piecework rates, and the men systematically limited their output to prevent the cutting-down of the prices.

Under the Taylor system not only is the time for each machine operation very carefully studied, but also every motion made by the operator in setting up the work. This

timing of each motion by stop watches very naturally engendered suspicion amongst the men, who looked upon it as preparatory to a crusade of "nigger-driving" which only the strongest could survive, while employers condemned the methods as being needlessly costly and complex.

The results where the Taylor system has been tried have proved that the cost of finding out the quickest way to do each job is far more than recovered by the time saved, while the workmen are enabled to earn much higher wages year in year out, without the slightest injury to their health, in fact their condition has been actually improved. As regards this feature, one aim of the system is to ascertain the amount of rest needed to enable a workman to keep up the speed without any possibility of wearing himself out.

Every employer who reads this book, and Dr. Taylor's works on the same subject, will be easily convinced of the advantages attaching to the system; the difficulty is to make the *men* understand the benefits accruing to *them*. This will be a slow process in the early stages, but there is little doubt that scientific management on these lines will extend and eventually become universal. In any case it is a subject which no manufacturer can afford to ignore, and we believe that Dr. Taylor's methods have already been very carefully studied by a large number of manufacturing firms in this country.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

1,562. "Holders for electric froning-irons." H. SAMELI. January 20th. (Complete.)

1,563. "Reverse current or power cut-outs." J. ROOTHAAN, J. DENHAM and FERRANTI, LTD. January 20th.

1,579. "Electric vulcanisers for tires." B. KISSHAZY. January 20th. (Complete.)

1,591. "Electric motor-control systems." SIEMENS BROS. DYNAMO WORKS, LTD., F. LYDALL and A. M. DUKE. January 20th.

1,592. "Electrical distant-control systems." SIEMENS BROS. DYNAMO WORKS, LTD., F. LYDALL and A. M. DUKE. January 20th.

1,598. "Electric measuring instruments." BRITISH THOMSON-HOUSTON CO. LTD., and A. P. YOUNG. January 20th.

1,599. "Electric switches." BRITISH THOMSON-HOUSTON CO., LTD., and H. C. HEATH. January 20th.

1,600. "Electric measuring instruments." BRITISH THOMSON-HOUSTON CO., LTD., and A. P. YOUNG. January 20th.

1,617. "Semi-automatic winding machines.." WESTERN ELECTRIC CO., LTD. (Western Electric Co., United States.) January 20th. (Complete.)

1,636. "Manufacture of chrome-alum by electrolysis." H. CHAUMAT. (Convention date, January 24th, 1912, France.) January 20th. (Complete.)

1,658. "Process of and means for forming clay solids employed in the manufacture of insulators and other articles." W. PODMORE. January 21st.

1,682. "Electric bell-pushes and the like." E. G. HARCOURT. January 21st.

1,716. "Telephone systems." E. A. GRAHAM. (Addition to 10,577/10.) January 21st. (Complete.)

1,735. "Circuit controlling device." WESTERN ELECTRIC CO., LTD. (Western Electric Co., United States.) January 21st. (Complete.)

1,745. "Method of and means for electro-plating certain articles." G. P. M. LEE and H. A. HARVEY & Co., LTD. January 22nd.

1,765. "Means for the control of electric pressure and current regulators." W. J. POOLE. January 22nd. (Complete.)

1,775. "Arc-light carbons." H. AYRTON. January 23rd.

1,776. "Apparatus for detecting and estimating certain substances by virtue of their polarising or depolarising action on an electrical couple." E. K. RIDEAL and U. R. EVANS. January 22nd.

1,780. "Two-line electric plug and sockets and the like." J. J. CLIFFORD and C. E. BUBELL. January 22nd.

1,795. "Means for intermittently indicating or displaying the names of stations or stopping-places in trains or other vehicles, or other situations or other devices or matter in such vehicles or other situations." C. J. EVANS and J. M. CATER. (Addition to 26,450, 1911.) January 22nd.

1,804. "Construction of incandescence electric lamps." O. SCHALLER. (Addition to 16,195, 1911. Convention date, August 23rd, 1912, Germany.) January 22nd. (Complete.)

1,812. "Production of gases by electrolytic processes." KNOWLES OXYGEN CO., LTD., and R. W. GRANT. January 22nd.

1,843. "Process and devices for producing in a continuous manner Röntgen rays, having any desired degree of hardness which can be adjusted at a moment's notice." J. E. LILIENFELD. (Addition to 23,169, 1912.) January 22nd. (Complete.)

1,855. "Electric measuring instruments." BRITISH THOMSON-HOUSTON CO., LTD., and A. P. YOUNG. January 22nd.

1,857. "Automatic regulators for level-compounding or over-compounding on alternating-current circuits." A. M. TAYLOR. January 22nd.

1,895. "Switch for electric lighting on a small scale." ELEKTROMECHANISCHE INDUSTRIE G.M.B.H. and F. HERMANN. January 23rd. (Complete.)

1,899. "Insulating sectional iron masts." SIEMENS BROS & Co., LTD., and G. W. PERRY. January 23rd. (Complete.)

1,902. "Telephone exchange systems." WESTERN ELECTRIC CO., LTD. (Western Electric Co., Belgium.) January 23rd. (Complete.)

1,915. "Manufacture of tungsten." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) January 23rd.

1,927. "Automatic electric switch." H. F. BIGGE and F. R. BUTT. January 23rd.

1,933. "Production of alkali metals by the molten electrolysis of alkali compounds." W. JOHNSON. (Deutsche Gold and Silber Scheide Anstalt vorm. Rö , Germany,) January 23rd.

1,935. "Electrolytic processes and apparatus particularly applicable to the production of alkali compounds." C. WHITE. January 23rd.

1,949. "Electric switches." G. HESSE and W. ZABEL. January 24th.

1,951. "Magneto-electric generating apparatus especially suitable for ignition in engines of motor-cycles and motor-cars." A. G. HINTON. January 24th.

1,978. "Filaments of incandescent electric lamps." E. M. LACEY. January 24th.

1,984. "Electric quick-make and quick-break vibration proof switch fuses." R. C. PERFECT. January 24th.

1,990. "Dynamo machines for constant output at various speeds." W. G. LEE and P. J. OLDFIELD. January 24th.

1,995. "Receiver for submarine signalling." SIGNAL G.m.b.H. (Convention date, June 1st, 1912, Germany.) January 24th. (Complete.)

1,996. "Receiver for submarine signalling." SIGNAL G.m.b.H. (Convention date, November 30th, 1912, Germany.) January 24th. (Complete.)

1,997. "Method of transmitting the effect of vibrations by wireless telegraphy." W. L. CORRY. January 24th.

2,001. "Wire drawing." BRITISH THOMSON-HOUSTON CO., LTD. (Genera Electric Co., United States.) January 24th.

2,022. "Telephone systems." E. A. GRAHAM. January 24th.

2,027. "Telephone or like apparatus and telephone systems." W. K.-L. DICKSON. January 24th.

2,070. "Mechanism suitable for use in connection with electric switches or for other purposes." A. H. F. PEEL. January 25th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

ELECTRIC PRINTING TELEGRAPHS. A. T. M. Johnson, F. H. Varley, Michaelis, Power and Johnson Secret Wireless Telegraph and Telephone Testing Syndicate. 22,079. October 6th. (Cognate application, 10,749 of 1912.)

ELECTRIC CLOCKS. C. Vogt. 27,291. December 5th.

1912.

DEVICE FOR THE TRANSMISSION OF SIGNALS UPON POWER TRANSMISSION LINES AND LIGHTING MAINS. Soc. Industrielle des Telephones. 412. January 5th. (January 5th, 1911.)

TELEPHONE SYSTEMS. W. H. Derriman. (Automatic Electric Co.) 687. January 9th.

ELECTRIC LAMPHOLDERS. G. St. J. Day. 750. January 10th.

ELECTRICAL APPARATUS FOR TRANSMITTING AND RECEIVING SIGNALS. Sir A. T. Dawson and G. T. Buckham. 777. January 10th.

APPARATUS FOR THE ELECTROLYTIC MANUFACTURE OF ALLOYS OF LIGHT METALS WITH HEAVIER METALS, AND THE CONTINUOUS TREATMENT OF SUCH ALLOYS FOR OBTAINING FINAL PRODUCTS. E. A. Ashcroft. 1,001. January 12th.

APPARATUS FOR THE ELECTROLYTIC MANUFACTURE OF LIGHT METALS AND REACTION PRODUCTS THEREOF. E. A. Ashcroft. 1,003. January 12th.

APPARATUS FOR THE ELECTROLYTIC MANUFACTURE OF CAUSTIC ALKALIES IN PURE ANHYDROUS CONDITION. E. A. Ashcroft. 1,004. January 12th.

CIRCUIT INTERRUPTORS FOR THE TRANSMITTERS OF ELECTRIC TELEPHONES. W. A. Logan. 1,168. January 15th.

OPERATION OF DIRECT-CURRENT ELECTRIC MOTORS. J. S. Peck and S. Eckmann. 1,865. January 17th.

ELECTRIC METALLURGICAL FURNACES. V. Stobie. 2,081. January 26th.

ILLUMINATED SIGNS ADAPTED TO BE SUPPORTED ABOVE THE GLOBE OR LIKE PART OF AN INCANDESCENT ELECTRIC LAMP. W. J. Beville. 2,566. January 31st. (Addition to 229 of 1912.)

TREATMENT OF METALS. British Thomson-Houston Co. (General Electric Co.) 3,752. February 14th.

ELECTRIC TELEPHONES. L. G. Hammer. 4,358. February 21st.

CONSTRUCTION OF TWO-WAY ELECTRIC SWITCH. G. Markt. 4,498. February 22nd.

ELECTRIC PHOTOGRAPHIC COPYING MACHINES. J. B. Halden. 5,278. March 2nd.

MEANS FOR DECREASING THE INJURIOUS EFFECTS DUE TO CAPACITY IN ELECTRIC CONDUCTORS. F. A. Becker. 6,061. March 11th. (March 15th, 1911.)

ELECTRIC CONTROLLERS. British Thomson-Houston Co. and H. C. Hastings. 7,704. March 29th.

GRIPPING AND SHEARING GRAPNEL FOR RAISING SUBMARINE TELEGRAPH CABLES. W. Hensman. 7,996. April 2nd.

ELECTRIC LIGHTING APPARATUS. F. Dussaud. 8,087. April 3rd. (April 6th, 1911.)

ELECTRIC IGNITION DEVICE FOR INTERNAL-COMBUSTION ENGINES. H. Bauer and M. Eckmeier. 9,492. April 22nd.

METHODS AND APPLIANCES FOR OBTAINING INSTANTANEOUS RADIOGRAPHS. Siemens and Halske Akt.-Ges. 9,499. April 22nd. (April 21st, 1911.)

ELECTROMAGNETIC SEPARATOR FOR THE WET SEPARATION OF ORES. Elektromagnetische Ges. 10,619. May 4th. (May 4th, 1911.)

REGULATION OF ELECTRIC INSTALLATIONS. H. D. Earl. 11,871. May 18th.

SPARK PLUGS. H. J. C. Forrester. (Marshalltown Motor Material Manufacturing Co.) 12,809. May 31st.

ELECTRICAL SWITCH CONTACT DEVICES. W. S. Hosford. 13,492. June 7th. (September 8th, 1911.)

AUTOMATIC ELECTROMAGNETIC CUT-OUTS. P. Wessel and T. Gysler. 14,120. June 17th.

APPARATUS FOR THE PRODUCTION OF HIGH-FREQUENCY OSCILLATING CURRENTS. V. F. Feeny. (National Wireless Telephone and Telegraph Co.) 14,735. June 24th.

ELECTRIC IGNITION APPARATUS. S. Rothschild. 14,738. June 24th. (November 16th, 1911.)

METHODS FOR COMPENSATING FOR THE FLUCTUATIONS IN THE LOAD OF ELECTRIC MOTORS. Siemens-Schuckertwerke Ges. 15,469. July 2nd. (July 8th, 1911.)

MAGNETO-ELECTRIC MACHINES. C. W. Hinksman. 15,704. July 5th.

OVERHEAD CONTACT CONDUCTORS OF ELECTRIC RAILWAYS. Bergmann Elektricitats-Werke Akt.-Ges. 15,980. July 8th. (August 23rd, 1911.)

ELECTRIC TRANSFORMER BOILERS. J. Bally. 16,043. July 9th. (July 20th 1911.)

REVOLVING ELECTRIC FURNACE INTENDED CHIEFLY FOR THE MANUFACTURE OF ALUMINIUM NITRIDE. Soc. Générale des Nitrures. 16,406. July 13th (August 4th, 1911. Addition to No. 29,299 of 1910.)

ROTARY MAGNETS. O. T. Blathy. 16,538. July 15th. (August 24th, 1911.

ELECTRIC IGNITERS. J. G. Cook. 16,664. July 17th.

DEVICE FOR AUTOMATICALLY ADJUSTING THE TIME OF IGNITION IN INTERNAL-COMBUSTION ENGINES USING MAGNETO-ELECTRIC IGNITION. Robert Bosch (Firm of). 17,029. July 22nd. (September 2nd, 1911.)

PORTABLE ELECTRIC HAND LAMPS. A. H. Hunt. 17,850. August 1st.